

SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXXVIII. — No. 20.
[NEW SERIES.]

NEW YORK, MAY 18, 1878.

[\$3.20 per Annum.
[POSTAGE PREPAID.]]

COMBINING THE STRANDS OF THE EAST RIVER BRIDGE CABLES.

In tracing the progress of making the superstructure of the East River Bridge, it will be remembered that we began with the manufacture of the steel wire, and afterwards explained how the great coils were unwound, and the wire carried across the river from anchorage to anchorage, to and fro, until it had been passed a sufficient number of times to make a strand. The wire, we stated, weighed one pound per eleven feet, and 261 wires made one of the strands, nineteen of which laid together constitute one of the four great suspension cables. These immense ropes are about 3,500 feet in length each, and extend between the eye bars of the anchorages. When finished they will be sixteen inches in diameter, and their object is to support the weight of the superstructure. Since last summer the work of making the strands has steadily progressed until now twelve belonging to each cable are finished, and a thirteenth is nearly ready for lowering into place upon the saddles on the piers. A sufficient number, therefore, has been completed to allow

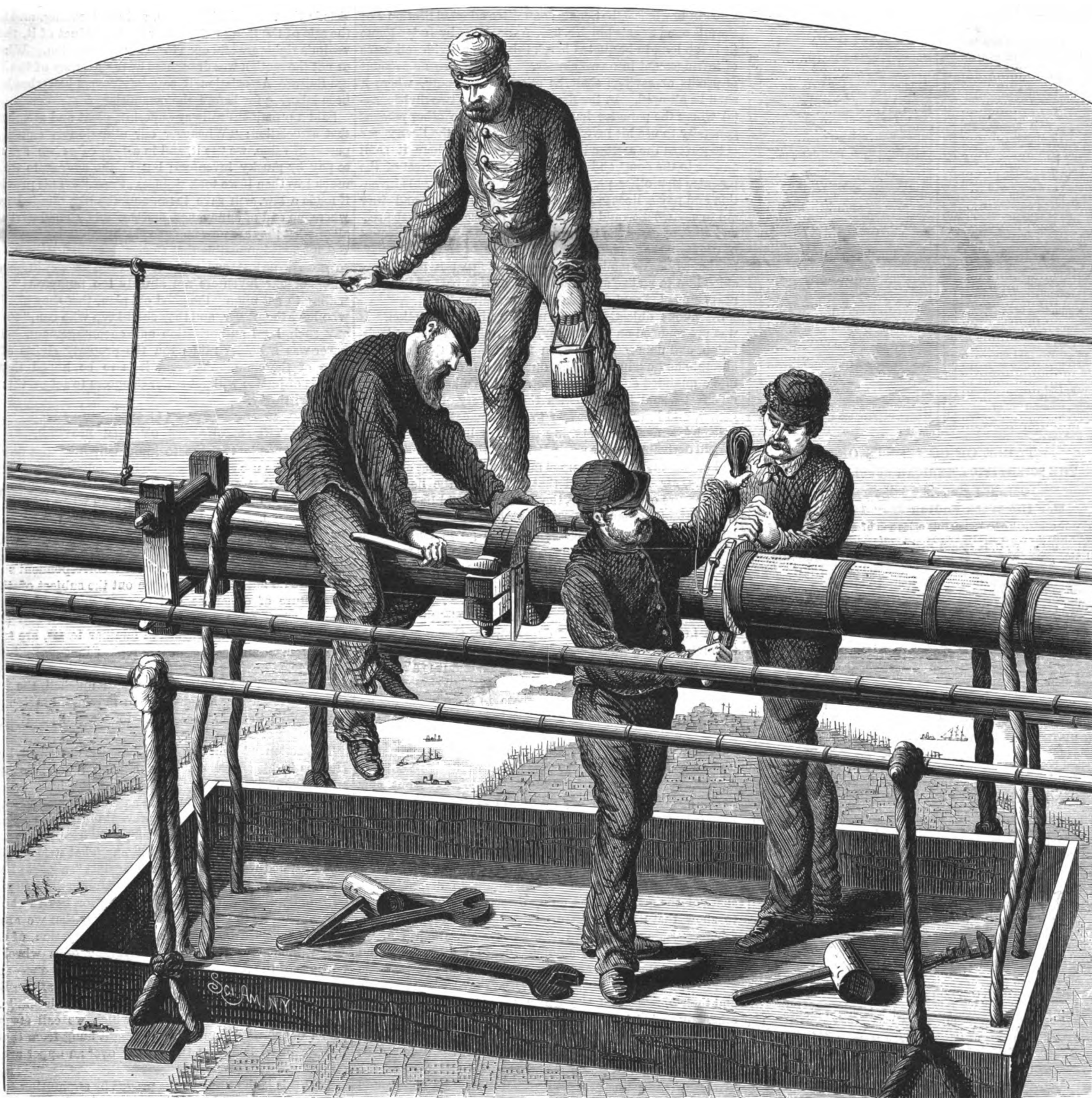
the assembling to begin, and to the first steps of this important operation we devote the present article and illustrations.

Each cable is composed of two portions, the core and the exterior envelope; the former consists of seven, the latter of twelve strands. When finished this distinction will be obliterated, as all the strands will be bound into one homogeneous cylinder, the object being to protect the wires from effects of the weather, and allow of the convenient attachment to them of the other portions of the bridge; otherwise the strands might lie loosely side by side as they now do. This binding will exist everywhere, except directly on the saddles, and here it is omitted for the obvious reason of the immense labor which would be required to lift the entire cable from the grooves, and which would serve no useful purpose. It follows consequently that, in placing the strands over the saddles, due regard must be had to their ultimate position in the cable, so that, referring to Fig. 2, page 306, the lower-most strand, 1, of the envelope is first laid, then the pair marked 2, then pair 3; above these come the seven

strands, in similar order, which go to make up the core. To enable the distinction to be clearly made between core strands and envelope strands, we have made the former black in Figs. 2 and 3.

It will be remembered that the strands are secured by their bights being passed over heavy pins which go through the eyes of the anchorage bars, and also that, after each strand was finished, wire wrappings were placed around it at short intervals apart. Before assembling those strands constituting the core, all these wrappings, excepting those on the center strand of the seven, are removed. Then, at a point twenty-one and a half feet distant from the eye bar ends, lashings are clapped on first upon the lower pair of core strands, then upon the three next above, and finally upon the upper pair, Fig. 3, the object being to draw the strands individually together horizontally. To haul them up close vertically, a rope is attached to one of the envelope strands, 2, Fig. 3, brought up around all the core strands, up again to form a long bight, around the core strands again, and finally secured

[Continued on page 306.]



CABLE MAKING ON THE EAST RIVER BRIDGE.

a height nearly equaling that to which the heel is raised in walking causes the board to hit the head, or the head to strike the board, whichever you may call it.

Now in walking a mile, or 5,280 feet, on level ground, in 20 minutes (ordinary gait), and taking military regulation steps of 28 inches each, one lifts the body $5,280 \times 12 \div 28 =$ over 2,363 times in the 20 minutes. This means that the body is lifted $2,363 \div 20 =$ about 118 times per minute. If the rise of the center of gravity is but one inch, and the body weighs 160 lbs., there will be $118 \times 160 \div 12 =$ 590 minute foot pounds, = nearly $\frac{1}{4}$ of a horse power, wasted just in lifting the body up and letting it come down again without any useful effect. In other words, the same amount of force expended in walking up 118 treadmill steps, each an inch high, in a minute, would develop $\frac{1}{4}$ of a horse power.

If, now, one were to walk so that the head and shoulders, as indicating the vertical position of the center of gravity, should not rise and fall with the steps, all this force would be saved; and if the muscles were of steel, and the motive power of the whole a spring, then walking on a level would resolve itself, very largely, into a question of overcoming the friction of the feet and joints, etc. But unfortunately (perhaps), the muscles are dependent, for their contraction and strength, upon the action of the motor nerves, and these last upon the mysterious chemistry, electricity, or whatever it be, of the brain and the nerves of volition. Thus, in holding the arm or the leg out steadily in any given position for even a short length of time, although there is no work being done, dynamically speaking, there is, to the muscular system, what amounts to the same thing, whether caused by action or by continued restraint—fatigue, followed by pain and by temporary paralysis if too prolonged—the limb dropping when the muscles refuse to perform their office.

There is thus much more physical fatigue caused by walking than corresponds to the 590 minute foot pounds, the foot pound account increasing arithmetically only, while the nerve tax mounts up in geometrical ratio. It is generally considered more "fatiguing" to come down a very long flight of steps, say those in Trinity Church spire, although lifting no weight, than to climb up, especially if one has taken no rest at the top.

We will now consider the work done by the velocipedist on a smooth and level mile course. Firmly seated, he causes the muscles of his leg to turn a wheel, and to do that only. His whole body is never lifted; and in one four-wheeled variety having treadle bars with reciprocating horizontal motion, even the weight of the legs is not raised, as in the common bicycle.

If an ordinary spring balance were fastened to the velocipede with rider in the seat, and the whole was hauled along, the spring would indicate in pounds the "draught," or the resistance due to the friction of the moving parts of the machine, and to that of the ground and the tires. A bicycle with driving wheel 3 feet in diameter would make $5,280 \div (3 \times 3.14) =$ about 528 revolutions per mile; and if we suppose the mile to be made in 20 minutes, the wheel has made $528 \div 20 =$ about 26 turns per minute. If the crank is 4 inches long, the vertical stroke of the foot is 8 inches, but the center of gravity of the limb, which is located in the thigh, has been raised only about half that, or say 4 inches. Supposing the legs to weigh 55 lbs., the work in lifting the legs is $55 \times 4 \times 26 \div 12 =$ 476 foot lbs.

But every pound of this, less the ridiculously small amount lost in overcoming the friction of hip and knee joints, etc., has been utilized on the down strokes of the cranks as driving force; whereas, in walking, the fall of the whole body (which is utilized in treadmill work) is wasted.

We thus see that the velocipedist in traveling does less lifting than the pedestrian, and does not waste that force. He also strains the muscles less, and hence can keep it up longer and go further than if on foot; or he can "speed up" without getting fatigued by reaching the limit of endurance of the muscles and their motor nerves.

Furthermore, the velocipedist is apt to choose a better track than if walking.

A case in which the leg power is so employed that the velocipedist wastes the, say, 476 foot pounds used in lifting his legs, but expends none in lifting the body, is where he sits in a wheeled frame after the style of the baby go-cart, and propels himself and the vehicle by pushing with his feet against the ground. If he were to sit in such a frame and haul himself along by winding up, on a drum worked by foot cranks, a rope attached to a fixed point ahead, the power expended in lifting the legs could be utilized on the down stroke, as in the regular bicycle.

We think we have now answered our correspondent's questions, at least so far that he can readily "cipher out" for himself the entire interesting problem of locomotion.

CAPTAIN EADS' PROPOSED IMPROVEMENTS OF THE MISSISSIPPI AND ST. JOHN'S RIVERS.

Backed by the prestige of his magnificent success in opening the mouth of the Mississippi, Captain Eads has now no difficulty in securing the whole people as his audience when he comes forward with two more great projects for national improvements. One of these is no less important than the work already accomplished, for it aims directly at the saving of the enormous expense of constructing the new levees along the Mississippi by a means as simple, and without doubt as efficient, as the famous jetties themselves. This means is,

briefly stated, to narrow the wide and shallow places of the river so as to confine its current to a uniform channel. The river naturally scours its bed out in the narrow parts and drops the sediment in the wider portions along its entire length, and wherever there is a widening there are the shoals, the islands, the snags, and the stumps which impede navigation.

To bring the wide parts to the uniform width Captain Eads proposes to cover the sand bars with brush and stone dams. These obstructions would cause a deposit of sand between them and force the waters to deepen the channel. The work should go on annually, the obstructions being gradually built higher, and finally, when the river had been brought to a uniformity of width, there would be a uniformity in depth, in current, and in transportation of sediment. This work could be much more easily accomplished than could the rip-rapping or matting of the banks, because it needs only to be done in shallow water. Levees are objectionable, it is argued, not because of the present amount needed for absolute protection from the near floods, for four or five millions would insure this, but it is because they must cave in at the wide places. Instead of diffusing the water by outlets and raising high levees at these points, as proposed by the United States Engineers, Captain Eads advocates its conservation—every drop of it—in one channel of uniform width, and the abolition of all the wide places, the closure of the outlets, and, if necessary, the closure of the island chutes. The United States Engineers propose to attack the bank of the river with shovels and wheelbarrow, to accommodate its anticipated elevation ten or a dozen feet higher than ever before. Captain Eads proposes to set the river to work in the bottom of its bed, as he did at the jetties, and, while deepening it for the benefit of commerce, to lower its haughty crest forever. They provide for a river carried threateningly above the land, a constant source of terror and anxiety, while he proposes that its vast volume, "in all the grandeur of its mightiest floods, shall be viewed with an admiration devoid of fear from happy homes safe above its surface."

Captain Eads' other project is the deepening of the channel through the bar at the mouth of the St. John's River, Florida. Here he suggests a system of jetties analogous to those used at the mouth of the Mississippi. He finds that there exists from Jacksonville to the sea a river basin 25 miles long and averaging one mile in width. At one end of this basin the average rise of the tide is nearly 1 foot, and at the other end $5\frac{1}{2}$ feet. The average quantity of tidal water passing into and out of this basin twice a day is equal to nearly 2,000,000,000 cubic feet. This would produce an average rate of current equal to 2 miles per hour, through a channel having a cross section of 30,000 square feet, or a maximum current during average flood and ebb tides of about 4 miles an hour. With such a tidal basin, even without the additional advantage of the river current resulting from a large annual rainfall upon 7,500 square miles drained by the river, Captain Eads thinks that there would be no question of parallel jetties acting otherwise than as a certain means for deepening the channel through the bar. The inflowing waters, now nearly 3 miles wide, would be caused to traverse a channel only three or four tenths of a mile wide. The frictional resistance would thus be greatly decreased, and higher tidal oscillations would occur at Jacksonville. The river channel would, therefore, not only be deepened over the shoals in the river by a higher plane of water at high tide, but the increased flow of tidal waters through the river would deepen the bottom likewise and materially improve the navigation of the river.

THE CONFECTIONER REGARDED IN THE LIGHT OF A COLORMAN.

Should the dealer in paints for decorative purposes, tiring of his vocation, suddenly conceive the idea of exposing for sale bucketfuls of brilliantly colored, ready mixed paints as newly discovered but extremely toothsome and healthful substitutes for our present articles of dessert, as well as harmless and delicious offerings to the candy-loving maiden and child, it is quite probable that the public, with its own convictions as to "the eternal fitness of things," would promptly spurn the proffered products of this new-fledged industry, and look with extreme pity, if not contempt, on the chemist who should rashly lend his name to testimonials asserting their harmlessness. And yet, if we are to believe the testimony of "experts" recently given in the Supreme Court of Massachusetts, at Boston, the trade of the confectioner would seem, in some cases, to be separated by but few removes from that of the colorman; the paints of the latter being mixed with linseed oil, while those of the former—identical in composition—are prepared for "internal use" with the more palatable materials, sugar and starch. This, of course, is a distinction; but, as far as the health and safety of the public are concerned, with very little difference.

The trial referred to was that of a Boston firm of confectioners on the charge of manufacturing and selling candy adulterated with chrome yellow, or, more accurately speaking, chromate of lead. In view of the poisonous nature of this pigment, to which we shall presently refer, the evidence elicited from the witnesses was remarkable. A former member of the firm, who had been in the confectionery business for twenty-five years, stated that he had made a specialty of the lozenge department and had never known a case of injury to a person arising from chromate of lead, and had never heard of any complaint against it. He had always been in the habit of eating lozenges freely, and although he

should probably not relish a grain and a half of chromate of lead, yet at the same time he should not consider it dangerous. One of the workmen testified that chrome yellow was used in nearly every large establishment in New York, and he, together with other workmen, had been in the habit of eating the raw article. He had no doubt that he had eaten between one and two grains at a time and never considered it dangerous to the extent it was used in making lozenges. One of the members of the firm testified that he was familiar with the confectionery business both in this country and in Europe; he had always taken the greatest precautions to have lozenges made pure (?), and, to the best of his knowledge, chrome yellow was very extensively used in this country; it was used to produce a harmony of color. By inquiry and observation he had taken pains to ascertain if chrome yellow was injurious, and among the chemists he had consulted was Dr. Liebig, in Europe.

The object of the defense in this trial seemed to be to prove that not only is chromate of lead (which includes "chrome yellow," "chrome green," "orange chrome," and the "American vermilion" of some manufacturers) not poisonous, but that, even if it were so, the small quantities in which it is used would render it harmless. In regard to the first proposition we may refer to a very recent case reported in the *Boston Medical and Surgical Journal* under the head of "Toxicology," where we find the following cases of poisoning by the inhalation of dust containing chrome yellow. The *Journal* says:

"Leopold reports five cases of this form of poisoning, one of which proved fatal. The patients were employed in weaving cloth, colored with chrome yellow (chromate of lead), which was quite loosely applied to the thread, so that a portion of the pigment was easily detached and became diffused throughout the air of the room. The patients were affected with a yellow-coated tongue, yellow sputa, loss of appetite, malaise, in some cases vomiting, pain in the region of the stomach and umbilicus, obstinate constipation, and debility. The faces were yellow. These symptoms disappeared in a few weeks after the removal of the cause, except in the case of an infant nine weeks old, who died in six or eight days after the beginning of the symptoms, which, however, did not appear until three weeks after exposure to the infected atmosphere. The symptoms in this case were fever, restlessness, shrieking, several yellow fluid stools daily, redness of the skin over the chest and abdomen, parched lips, and, just before death, short respiration.

"After death there were found inflammation and perforation of the stomach, the same appearances which were seen in the two cases previously reported by Dr. Von Linstow, caused by ingesting the chrome yellow. None of the poison could be detected in any of the organs except the lungs, in which 3.6 milligrammes (0.055 grain) were found."

As to the second proposition, the small quantity used: there are but two to three salts of lead that as medicines are adapted for internal administration; and, when it becomes necessary for the physician to employ them in this manner, he uses them cautiously, and in what are called "medicinal doses," for it is well known that continued doses of exceedingly small quantities are the very ones that produce all the dangerous constitutional effects of the lead.

Familiarity with poisons, as with other things, is apt to breed carelessness in handling, if not contempt for their effects; and, because the worker among them testifies to their innocuousness to his own system when self-administered, it by no means follows that the practice is a safe one to recommend to the public. At all events, no such testimony as we have referred to above will serve to remove the prejudice that exists in the minds of parents against allowing their children to be fed on substances that are known to be injurious.

The vegetable kingdom yields such a large number and variety of harmless coloring matters, exactly suited to the requirements of the confectioner, that there is no necessity for resorting to the use of either colored earths or metallic salts, and their employment, therefore, being not only inexcusable, but criminal, should be promptly punished by the arm of the law.

CONGRESS TO BE MADE A PATENT MILL.

If that portion of the new patent bill is passed which provides for the lapsing of a patent in event of the non-payment of an auxiliary fee a few years after its issue, one result will be to convert Congress into more of a patent manufacturing concern than it already is. Every Congressman knows now that not a session passes but that legions of inventors, who have failed or who think they have failed to realize as much as they should during the lifetime of their patents, fill the records with applications for extensions. It was to relieve Congress from this increasing burden that the duration of the patent was lengthened from fourteen to seventeen years, the object being to afford the inventor more time to gather his profits. Under the provisions of the proposed new law, however, it must be obvious that Congress will be besieged by applications to revive patents which have lapsed because poor inventors may not have had the means to pay the additional fees required at the time fixed by law, and for a great variety of other reasons which will be urged. We have already pointed out other objections to this enactment, but the above in its results is by no means one of the least serious, as the consequence will be to engender an immense amount of special legislation, to take up the time and materially augment the work of Congress, and to hinder the progress of measures of public importance.

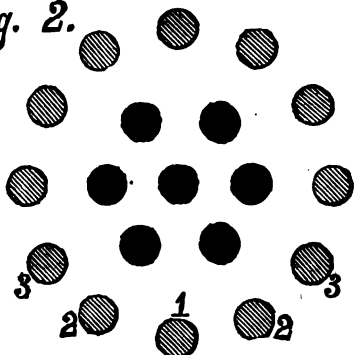
[Continued from first page.]

to the corresponding strand, 2, of the envelope on the other side. The hook of a derrick tackle is then put in the bight, and in this way the parts are drawn together. The cross lashings between the strands are then removed. At a few inches inside of the 21 foot 6 inch mark a wooden clamp is applied, and some three feet outward another clamp is attached. Four or five more of these clamps are put on the core between anchorage and pier, for example, and the permanent assembling then begins.

Between the wooden clamps, a massive iron clamp is applied, and its parts are brought together by powerful lever wrenches. This compresses all the strands into an even cylinder, individual wires being prevented from slipping into the joints of the clamp by the downwardly extending horns shown at A, in Fig. 4. There is a special object in thus drawing the core strands so tightly together, namely, to compress them not into a mere assemblage of ropes of circular section, but into a uniform cylinder, of which each strand except the center one will form a segment, as shown in Fig. 4. To assist this formation the strands are beaten into place by heavy wooden mallets, and aided by wedges. The workmen carefully place in proper position such wires as may protrude beyond the smooth cylindrical surface. Now comes the binding, and to do this a buggy is attached to the core, and moved along as the lashings of wire are put in place. The first binding is put on just inside the iron clamp. It consists of No. 14 wire, wound on by an iron ring which encircles the core and has handles to allow of its easy revolution. To this ring the wire is attached, and two men at the handles serve the wire tightly around the core for about 25 turns, the core being previously white-leaded. The end of the wire is secured, the iron clamp shifted ahead, the core is again compressed, another binding is put on, and thus the work progresses, the lashings being about a foot apart.

Three workmen generally occupy the perilous swinging

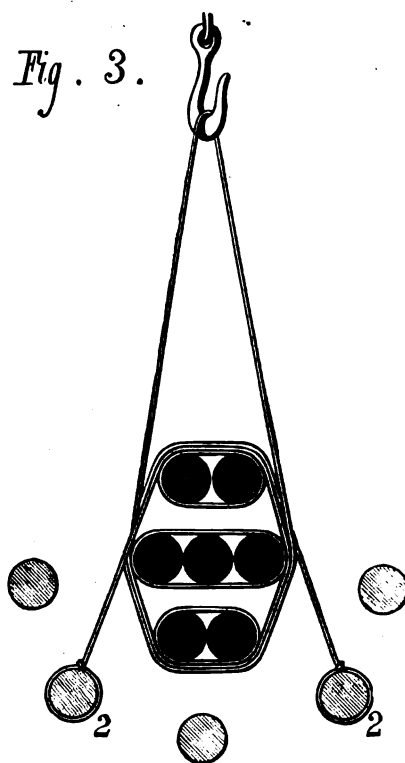
Fig. 2.



tray called the "buggy," two engaged as above described, a third handling the wire, and perhaps a fourth man helps in various ways. The dizzy aerial perch of the bridge builders is shown in the engraving on our initial page, and it would seem that they worked on it almost at constant risk of their lives. Yet no accidents by falling have yet occurred. In fact the construction of the great bridge has served to show in a striking manner how men can become habituated to living and working under abnormal conditions, for examples of these are found in the dense atmosphere of compressed air in the caissons while the latter were being sunk, and in the unguarded swinging platforms which traverse the lofty cables. The men seem perfectly at their ease, however, and even tempt fate by walking out on the cables alone, sometimes holding by the slight hand rope provided, or occasionally scorning even this safeguard. The reader may get an idea of the nerve required for this feat by imagining himself walking on a log about ten inches in diameter, placed at an angle of fifteen degrees or so, and at an elevation of a couple of hundred feet. Professional rope walkers, when they essay a performance of the kind, carefully rosin their stocking feet

and use a heavily weighted balancing pole; but these workmen walk along unconcernedly with their heavy boots on, and even trot down the inclines, barely touching the hand

Fig. 3.



rope. One of them laughingly told us that working on the buggy, and getting in and out in the above perilous fashion, had one advantage at least, and that was that tools were safe. Predatory visitors would never find their cupidity sufficiently excited to tempt them from the dizzy foot bridge upon the still more dizzy, narrow, and often greasy core.

When the core is all bound the upper strands, as fast as completed, will be lowered into place, and finally, when all are finished, the core lashings will one by one be taken off, and the whole cable bound together in precisely the same way as above described, larger clamps being of course used. This work, it is expected, will be ended by the coming fall.

ADVERTISING—A MODE OF MOTION.

When Toddie, in that nursery classic "Helen's Babies," expressed his desire to examine the mechanism of a watch by wanting "to see the wheels go 'round," he hit upon a peculiarity of the human race by no means confined to its younger members. Whether it is, as a recent writer on physiological aesthetics has suggested, that anything indicative of life is more agreeable as an object of contemplation than one capable of being associated, however remotely, with thought of death, moving objects being an example of the first, and objects at rest of the second, it is certain that to every one the sight of mechanism in operation is more or less agreeable, and it would seem that the degree of pleasure depends in some measure upon the motion being unusual or unexpected. There is abundant room for speculation on this which we shall not indulge in here, as we mention the topic simply to note that some such mental operation peculiar to most people has recently been turned to account by inventors to enlist attention to advertising signs.

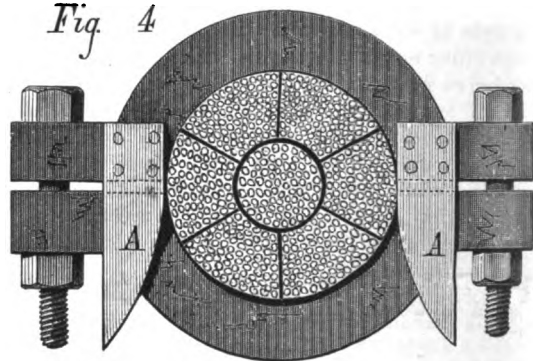
It is positively funny to ride in any horse car in this city, and watch the passengers, sober elderly men and uncontrollable youngsters alike, all gazing fixedly at the moving pasteboard figure of a washerwoman scrubbing clothes, or of a cobbler sewing shoes, or some similar device, inserted in the advertising panels of the cars by enterprising business houses, and kept in motion by the jolting of the vehicle. Why elderly people should persistently stare at these toys is incomprehensible.

We watched a well known and learned judge the other

day sit as if fascinated gazing at the figure of a codfish wabbling about in the middle of a fish dealer's advertisement, his newspaper, meanwhile, lying opened, yet unread, on his lap. It is perhaps useless to seek a reason for this. The eye, it is said, delights in circles and curved lines, on account of the gradual use into which all the muscles are called; but we cannot see how it can delight in the irregular vibrations of a pasteboard codfish fastened on a spring. Some people have told us that these moving signs make them actually unhappy—they feel that they must look at them, as if drawn by an irresistible attraction—like Mark Twain's clerical friend who, after once learning the famous horse car jingle beginning "The conductor when he receives a fare," never could get it out of his head, but repeated his sermons in the same rhythm.

Sensitive people can of course avoid uneasiness of this kind by refusing to patronize cars containing such advertisements, but we fear this mode of escape is short-lived. Another inventor (some nervous individual will assert, actuated by a fiendish and malicious purpose) has contrived a sign which cannot be avoided; it must be looked at. In every one of the large gilt letters this ingenious person makes numerous circular holes. In every hole he suspends a bright tin disk, each being so arranged that all may be vibrated from the moving armature of an electro-magnet, in which the current from a battery fastened behind the sign is alternately broken and established. We do not believe that any one can come within a block of that sign without being morally dragged into looking at it. A crowd, as we write, is standing open-mouthed staring at it. As an individual sign it is an astonishing success, and everybody who sees it will depart with the words "Homes in Florida" persistently flickering on his retina and shaking through his nervous system, dimly suggestive of the tremulous malady incident to Florida swamps. But then, supposing this sign came into general use; suppose both sides of Broadway

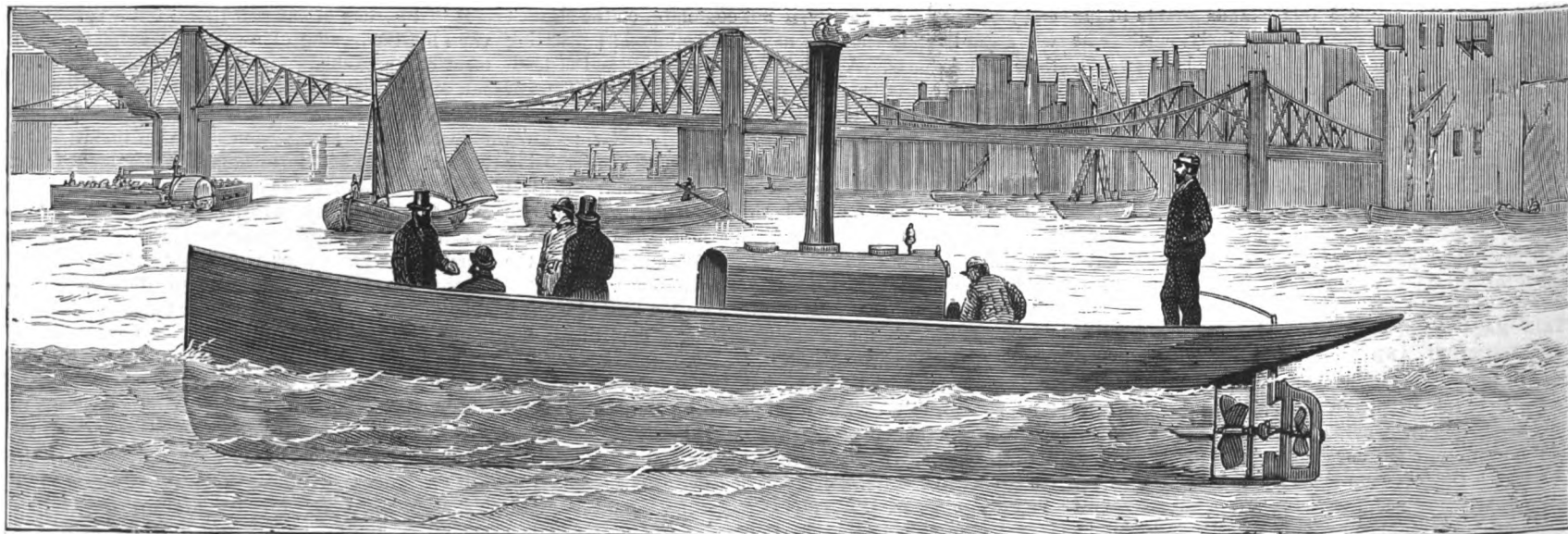
Fig. 4



united in one grand twinkle and flicker—the idea is too horrible. Some of our readers may have vivid imaginations combined with sensitive nerves, so we forbear.

A RUDDER AND SCREW COMBINED.

The object of this steering apparatus is to make a vessel to turn more quickly than it can be made to do by any other means, an achievement which is manifestly desirable in view of the many collisions which occur from deficiency of steering power. It is claimed to be applicable to vessels of all sizes, and can be worked either by steam or other motive power, and in conjunction with, or entirely separate from, the ordinary screw propeller, and it has the additional advantage of increasing the speed of the vessel when going straight ahead. A glance at the engraving, for which we are indebted to the London Graphic, will show that a screw is fitted in the rudder, and this screw is connected with the revolving shaft by means of a universal joint, so that, in whatever position the rudder may be placed, the screw continues to turn, and the course of the vessel is altered with ease and speed.



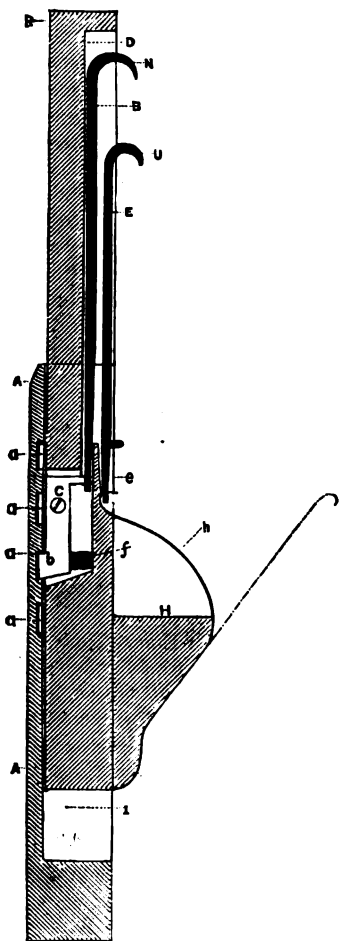
THE KUNSTADTER RUDDER SCREW.

credit on the author, but also on the new, but energetic and accomplished, society over which he presides.

Plant Crystals.—At a recent meeting of the East Kent (Eng.) Natural History Society, Professor Gulliver, F.R.S., exhibited numerous drawings of *Raphides*, and other microscopic plant crystals, accompanied by explanatory remarks. From the latter we glean the curious and novel information that some trees and other plants, from stem to branches and leaves, are invested with a most delicate network, or tessellated pavement like mosaic work, of cells all studded with *spheraphides*, so that each cell is set and adorned with a gem of one of these beautiful crystals. The "Angelica tree" (*Aralia spinosa*) was said to form an example, beneath its bark or epidermis, of this external skeleton of crystalline tissue. And an internal crystalline skeleton was shown in other plants, including some *Leguminosae*, as may be well seen in the common white clover, the crystals being arranged in chains along the vascular bundles. Mr. Gulliver remarked that, boiling a portion of the plant before its examination, in the solution of caustic potash which is kept by druggists, exposes the crystals very clearly. He added that he had learned that the long crystal prisms of the iris tribe are admirably suited for experiments on polarization of light; and he believed that the whole subject of plant crystals belongs to the vast domain of the cell biography of plants, which has hitherto been too sadly neglected, but which must be diligently cultivated before we can hope for the most complete system of botanical classification and knowledge of the laws which govern the vegetable kingdom.

SHUTE'S ADJUSTABLE SAFETY STILT.

The accompanying engraving is a sectional view of a new stilt, which is so constructed as to be capable of being raised



IMPROVED STILT.

to any desired distance from the ground, and from which the wearer can release himself in case of falling by freeing a spring hoop which passes over the foot. The device is made in two parts, one having guides and sliding in a channel, I, in the other portion, A. There are recesses or indents, *a*, in the bottom of the channel, I, to any desired number. R is the handle, and H the foot piece made on its lower end. The handle is provided with a catch, *b*, pivoted in a recess at *c*, with a spring, *f*, placed behind to throw it outward; and the lower end of rod, B, sliding in a groove, D, made in the handle, is connected to the rear side of the catch at its upper end. When the rod, B, is pulled upward by the hook, N, the lower protruding end of the catch *b* is drawn in, when the socket, A, being moved a little up or down, and the rod released, the catch, *b*, will snap into any of the recesses, *a*, as may be desired to make the stilt longer or shorter, or the foot piece, H, nearer to or farther from the ground. In moving it up or down the handle, it is kept in proper position in the channel, I, by cleats fastened to the face of the socket, A. In the same groove, D, is a rod, E, held down by a staple, and spring hoop, *h*, is secured to the other side of the foot piece, H, which is sufficiently long to be bent inward over the foot piece. Its upper end is secured inside the latch rod, *e*. The object of this spring hoop, *h*, is to assist in securing the foot to the foot piece, H, and it may be released and the spring caused to fly outward instantly (as shown by dotted lines in the engraving), if there is any danger of falling, by pulling up the latch rod, E, by the hook, U.

For further particulars as to rights or for descriptive circulars, address the inventor, Mr. Charles S. Shute, Springfield, Mass.

TOO MANY NAMES.

Professor Hayden, at the late meeting of the Academy of Sciences, called attention to the inconveniences arising from the duplication and even multiplication of the same name, as applied to towns or geographical localities in this country. There was some discussion as to the best means of checking this source of annoyance to geographers and the Post Office people, and Professor Gilbert thought that the Land Office might in some way interfere to check the repetition in new towns of the West. But this would not help matters for places that are already named. For instance, the current *Post Office Guide* gives twenty-eight Washingtons, and fifteen places have Washington as a prefix, with the further designation of Corners, Court House, and in one case the euphonious Gulch. There are three New Yorks, seven Philadelphias, a dozen Bostons, sixteen Albanies, and thirteen Providences. The ubiquitous Smith has modestly given his cognomen pure and simple to but one town, but he lavishes it in connection with various endings. Smith has eight "Mills," three "Landings," twenty-three "Villes," besides innumerable "Fords," "Gaps," "Flats," and "Ferries." A few moments' examination of any gazetteer will show that this practice of multiplying names is degenerating into a nuisance, and, in directing notice to the fact that in fixing new localities through the surveys of the Western Territories the same multiplication is constantly occurring, Professor Hayden utters timely warning.

It is not so easy, however, to devise a remedy. Certainly any man who makes a clearing and builds a log cabin has the inalienable right to call his habitation what he likes; and if somebody else builds alongside of him, that somebody may designate his hut as he pleases. This is the English style, where everybody that has a country seat, if it is on only a twenty-five foot lot, calls it this or that Hall, or some other fine sounding name, and the Post Office people eventually learn and remember it. But if settler No. 2 agrees with settler No. 1 that both cabins shall be known as Paris, they are not infringing any law of the land; neither are settlers Nos. 3 and 4, who squat five miles off and agree to call their hovels Paris also. There is nothing in the Constitution about this, and we fail to see how the military or civil power could reasonably be requested to interfere and pull down one or the other Paris in the event of the owners thereof declining, like Romeo, to throw off the name which is no part of them. In fact we do not see how any reform could be made among the twenty-eight Washingtons, for example. Shall we establish a court and try the cause on the interference principle, making each town prove priority of application of name? The result would be twenty-seven nameless towns, and twenty-seven populations eagerly demanding information as to where they lived anyhow. Or shall we devise a system of geographical copyright or patent, so that any town which appropriates a "new and useful" name may have exclusive right to the same, after an official examination? The opportunity of calling into existence a new host of officials should render this scheme especially luring to the congressional mind; and the litigations incident to disputes between similarly named towns would be useful to the legal profession. The last resort is, when we take the next census, to require county authorities, in which there are similarly entitled localities, to alter the names. The State authorities might then carry through a like revisal in cases where similar names occurred in different counties, and the United States Interior Department adjust matters where similar names occurred in different States. This would be a troublesome and probably costly proceeding, and the result now would be scarcely worth the labor; but, on the other hand, if similar names are to go on multiplying throughout the West as they have in the East, the line will have to be drawn somewhere, if only out of regard to the rising generation, who must study the geography of the country.

Photos in Colors.

The principle of the production of the Albert process for the production of colored photographic prints is that three negatives are made after the colored original, one in which the blue had no effect upon the plate, but all the other colors. This negative is used for the production of the Lichtdruck plate for blue color. In the second negative all colors take effect except yellow; in the third, all colors except red. The second negative, therefore, forms the Lichtdruck plate for the yellow; the third, that for the red color. All three plates are printed upon the same paper, and furnish the complete picture.

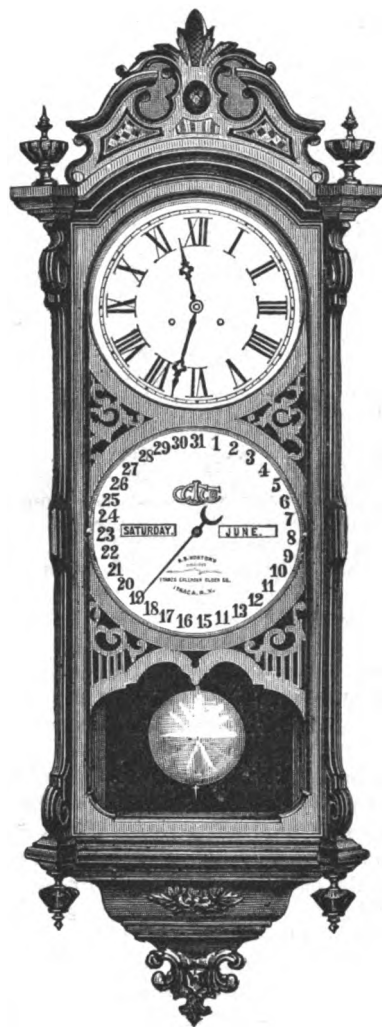
Gold Lace.

Gold lace is not gold lace. It does not deserve this title, for the gold is applied as a surface to silver. It is not even silver lace, for the silver is applied to a foundation of silk. The silken threads for making this material are wound round with gold wire, so thickly as to conceal the silk; and the making of this gold wire is one of the most singular mechanical operations imaginable. In the first place, the refiner prepares a solid rod of silver about an inch in thickness; he heats this rod, applies upon the surface a sheet of gold leaf, burnishes this down, applies another coating, burnishes this down, and so on, until the gold is about one hundredth part the thickness of the silver. Then the rod is subjected to a train of processes which brings it down to the state of fine wire; it is passed through holes in a steel plate lessening step by step in diameter. The gold never deserts the silver, but adheres closely to it, and shares all its muta-

tions; it is one hundredth part the thickness of the silver at the beginning, and it maintains the same ratio to the end. As to the thinness to which the gold coated rod of silver can be brought, the limit depends on the delicacy of human skill; but the most remarkable example ever known was brought forward by Dr. Wollaston. This was an example of solid gold wire without any silver. He procured a small rod of silver, bored a hole through it from end to end, and inserted in this hole the smallest gold wire he could procure; he subjected the silver to the usual wire-drawing process, until he had brought it to the finest attainable state—being, in fact, a silver wire as fine as a hair, with a gold wire in its center. To isolate this gold wire he subjected it to warm nitrous acid, by which the silver was dissolved, leaving a gold wire one thirty thousandth of an inch in thickness—perhaps the thinnest round wire that the hand of man has yet produced. But the wire, though beyond all comparison finer than any employed in manufactories, does not approach in thinness the film of gold on the surface of silver and gold lace. It has been calculated that the gold on the very finest silver wire for gold lace is not more than one third of one millionth of an inch in thickness, that is, not above one tenth thickness of ordinary gold leaf.—*Coventry Standard*.

IMPROVED CALENDAR CLOCK.

Our engraving represents an ingenious clock, wherewith is combined a calendar that perpetually indicates the hour of the day, the day of the week, the day of the month, and the month of the year. This calendar apparatus, being purely a gravity machine, not operated by any spring or levers, and requiring but a very slight weight to be raised



THE ITHACA CALENDAR CLOCK.

and dropped once in twenty-four hours, does not entail, we are informed, any perceptible labor upon the clock movement, as the necessary work is evenly divided through the whole twenty-four hours. The most delicate watch movement made, it is claimed, has ample power to operate the largest calendar. The apparatus within itself makes all the leap year changes, and if properly started (there being carefully printed directions with each clock), kept wound up, and running perpetually, will show upon its face accurately all the information above noted. Each calendar, before leaving the manufactory, is tested on a specially invented machine for that purpose, whereby all changes through eight years of time are repeated, so as to render a perfect record certain when the clocks go into service. The illustration represents a bank calendar clock with 12-inch dials, of the type often used by jewelers for regulators. For further particulars see advertisement of the Ithaca Calendar Clock Company in our advertising columns.

William Orton.

We note with much regret the death of Mr. William Orton, President of the Western Union Telegraph Company. Mr. Orton was a self-made man, beginning life as a printer's boy, and gradually rising through various positions in mercantile and political life, until in the office he last held he found ample scope for his great enterprise and rare executive ability. He possessed a ready appreciation of inventors' work, and was quick to advocate the adoption and use of new and improved devices calculated to add to the extension and efficiency of the telegraph system or the convenience of the public. He died at the age of fifty-two years.

THE BUCKEYE AUTOMATIC STEAM ENGINE.

The accompanying engravings represent the latest improvements in a horizontal steam engine, built by the Buckeye Engine Company, of Salem, Ohio, which is claimed to possess many new and sterling features both in design and construction. Fig. 1 shows a longitudinal elevation on the valve chest side. Fig. 2, a horizontal section of cylinder and valves. Fig. 3, the governor. Fig. 4, we are informed, is an exact facsimile of a pair of cards from a Buckeye engine of 250 H. P., in Lafayette, Ind., showing its performance.

By reference to Fig. 1, it will be seen that the general design is symmetrical and well conceived. Both cylinder heads are sunk from four to six inches into the cylinder, and being cast hollow are filled with non-conducting material, as is also the space under the cast iron jacket, the entire surface being thus protected from external condensation. The piston is of the well known Babbitt-Harris type, consisting of sectional rings set out by German silver springs. The crosshead is divided vertically and lengthwise into halves. Into this the steel piston rod is screwed, and the halves are clamped firmly upon the thread and upon the taper and shoulder of the pin by three strong bolts. There is claimed to be no possibility of the rod backing out; the use of jam nuts or keys is avoided, and instead of compensating for the wear of the connecting rod brasses by putting in liners, the bolts are slacked, the rod is screwed in sufficiently, and the parts are clamped fast again. The guides are flat surfaces with a central V groove, and both the top and bottom guides are oiled from graduating cups with glass bowls, as seen in Fig. 1, thus avoiding the use of the squirt can. The shafts are hammered, and have exceptionally large and long bearings, the proportion invariably being, length of bearing the diameter of cylinder, and diameter of shaft one half the diameter of cylinder. The crank head, fly wheel, and connecting rod are carefully balanced.

By reference to Fig. 2, the main valve is seen to be a hollow box, taking steam on the inside, balanced by the exclusion of steam pressure from the back, and driven in the usual way by an eccentric fast on the shaft. Steam is admitted from the inside of the valve to the cylinder and exhausted into the chest, the reverse of the ordinary operation. For this the following advantages are claimed: The valve seat is brought close down to the bore of the cylinder, and the engine being two ported, and these ports short and direct, the clearance volume is reduced to less than two per cent of the volume of the cylinder; the chances of leakage are reduced one half; freedom from back pressure is attained; surface condensation is avoided; and the live steam is enveloped in hot exhaust instead of being exposed to cold air. There being no pressure in the chest, no packing is required in the joints, and the valves and piston can be readily inspected for leakage by running the engine with the chest lid removed.

The valves are fitted up under steam at 80 lbs., insuring freedom from leakage or cutting from distortion caused by expansion under heat or pressure. The cut-off mechanism consists of a light cut-off valve, working on the inner face of the main valve, the stem passing out through the hollow steel stem of the main valve, and being driven from a loose eccentric on the shaft with a special motion derived from the compound rock shaft. This loose eccentric is controlled by the governor, Fig. 3, which is a shell fast upon the shaft and revolving with it. In this shell are pivoted two weighted levers, the outer ends of which are linked to the flange on the elongated sleeve of the loose eccentric. The centrifugal force developed in the weights throws them outward, and two well-tempered steel coil springs furnish the centripetal force. The system being coupled is independent of gravity, and it is readily seen that the speed determines the position of the weighted arms, which, in turn, determine the angular advance of the eccentric and the consequent point of cut-off, the range of which is, we are informed, from zero to nearly three quarters of the stroke.

All parts of the governor are relatively at rest while running, and hardened steel ball and socket joints secure flexibility. The whole system is claimed to retain the well known advantages of slide valves, and to secure perfect im-

The company claim, in the highest degree, and will in all cases specifically guarantee, power, economy, and especially absolute and sensitive governing. A perusal of their illustrated circular and a critical examination of the engine will repay the manufacturer or mechanic.

Three of these engines were exhibited at the Centennial International Exposition, Philadelphia, and two of them, of one hundred horse power each, are now furnishing the entire power at the Permanent Exhibition.

The company have recently opened an office and warehouses at 87 Liberty street, this city, where their engines can be examined, both in stock and running, and where information can be obtained.

New Inventions.

Mr. S. W. Poland, of Monson, Mass., has patented an improved Vapor Escape Attachment for Cooking Apparatus, consisting of jointed

and adjustable escape pipes, which are connected by swinging horizontal portions to intermediate steam drums, and finally to an exit in the stovepipe.

A Galvanic Battery, intended especially for running light machinery, has been invented by Mr. C. A. Hussey, of New

York city. When in use it has the functions of a "dry" battery, and is not liable to spill the liquid contents or to be deteriorated by the saturation of the exciting liquid by the zinc salts. There is an exterior zinc cup with an open bottom, and an interior porous cup with perforated bottom, the space between the two, and in the porous cup around the carbon pole, being filled with absorbent packing, which permits the liquids to be drained off at the bottom.

Mr. Adam Collignon, of Westwood, N. J., has patented an improved Steamer Chair, which is easily adjusted to a variety of positions as a reclining chair, and which may be folded into a compact form.

A new Flux Compound for Emery Tools, which is claimed by the inventor to cause remarkable resistance to abrasion, has been patented by Mr. August Cesar, of New York city. It is composed of quartz, red lead, glass, saltpeter, and borax, mixed in certain proportions and treated in a peculiar manner.

An improved Carpet Lining, invented by Mr. R. J. Macdonald, of New York city, is made of paper stock or similar material, in a continuous sheet, and cut at intervals in such a manner that small portions of the sheet may be lapped under, forming spring supports for the carpet and providing pockets for the dust.

Mr. Daniel Martin, of Hotchkissville, Conn., has patented a Pocket Knife for Opening Cans, which is simply a knife of the usual construction, to which is added a short beveled blade for opening cans, a pin on the blade serving to assist in opening the knife and as a stop in opening cans.

An improved Wagon Seat Spring, invented by Mr. J. F. King, of Edwardsville, Kan., consists of two or more rigid bars jointed together, and having between them, near their joints, blocks of rubber, which are compressed when the bars are moved toward each other, and expand when the bars are released. Springs made on this principle are applicable to a variety of uses.

Mr. H. A. Walker, of Ranaleburg, N. C., has patented an improved Saw Cleaner for Cotton Gins, consisting of a series of notched wipers, composed of flexible material, and attached to the periphery of a drum or wheel which is rotated at the back of the gin saws.

Mr. J. H. Martin, of Hartford, N. Y., has patented a Combination Chair, a single piece of furniture, which is constructed to be used as a chair, an ironing table, a step ladder, and a commode, being adjustable to each use as desired.

A convenient form of Sealed Cans, for paints, canned goods, etc., invented by Mr. A. J. Noltz, of Chattanooga, Tenn., is made with a circular slot in the top, closed by a strip which is soldered on, this strip being provided with a ring at one end, by means of which it may readily be removed without the use of a knife.

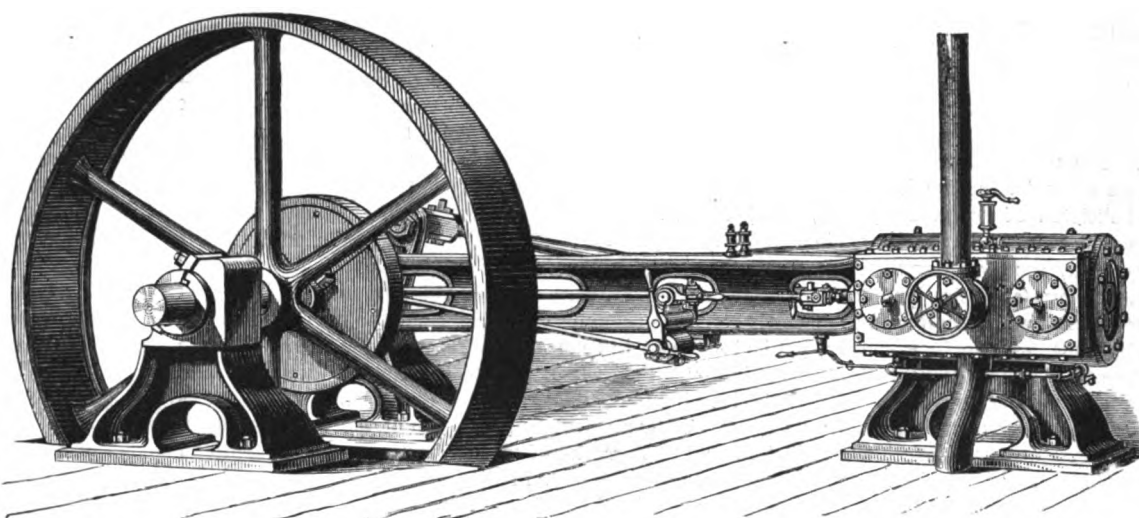


Fig. 1.—THE BUCKEYE AUTOMATIC STEAM ENGINE.

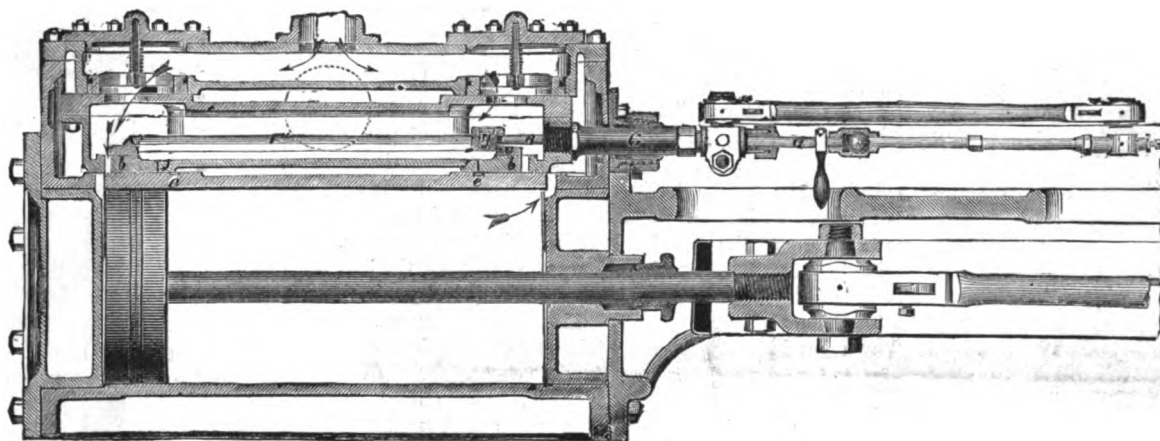


Fig. 2.

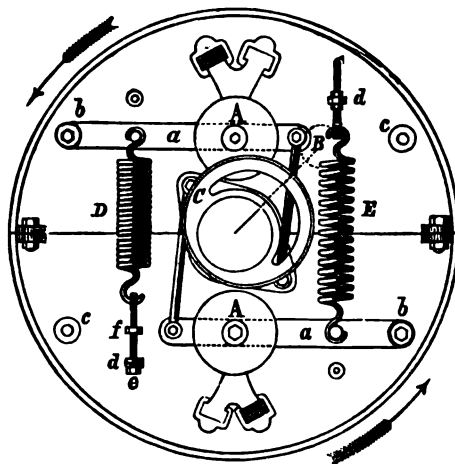
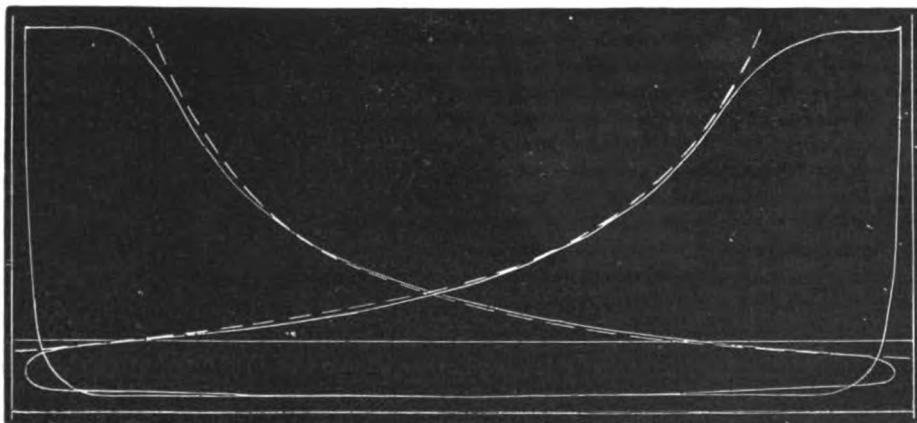


Fig. 3.

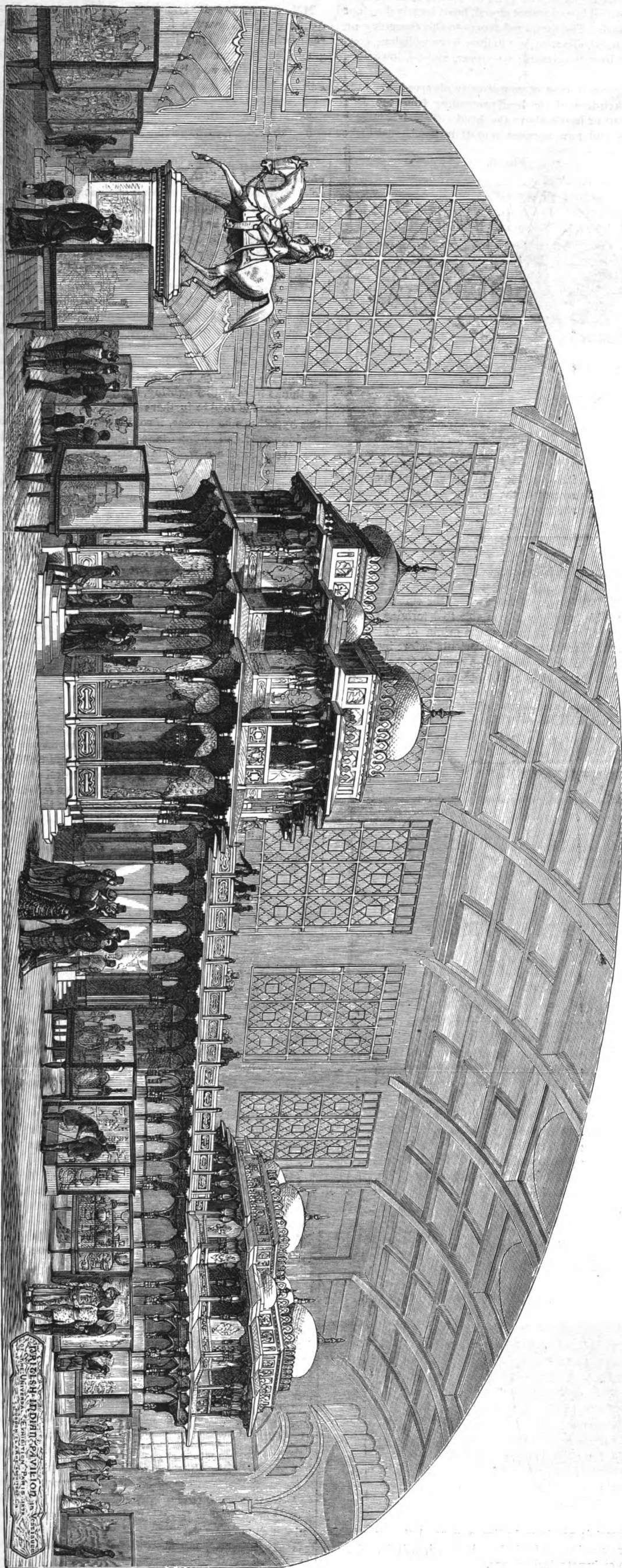
cocks which relieve automatically from water, and an ingenious device for oiling the crank pin from a can while running.

The piston speed is, for all sizes, 500 feet per minute.

Fig. 4.



THE BRITISH INDIAN SECTION AT THE PARIS EXPOSITION.



THE BRITISH INDIAN EXHIBIT.

The main building of the Paris Exhibition is divided longitudinally into two sections, of which the eastern portion appertains to France, and the western to foreign countries. More than one fourth of this latter space is occupied by England and her colonies, British India being especially conspicuous. An interior view of the section appropriated for its exhibit we copy from the *London Graphic*. The greater part of the space is devoted to the display of the fine collection made by the Prince of Wales during his Eastern travels, and this collection will undoubtedly be one of the prominent features of the exhibition. His Royal Highness is described by the English press as being deeply interested in the work of rendering the exhibit under his charge as successful as possible.

Probable Iron Mines in Syria.

Professor Osborn, of Oxford, Ohio, has recently been examining some iron ore from the Lebanon Mountains of Western Syria, with these results:

"Among other minerals, a specimen of supposed iron ore has been brought from near the foot of a prominent Lebanon peak, well known to tourists as Jebel Keneiseh. The locality, as described to me by the finder, is on the French road from Beirut to Damascus, twelve miles east of Beirut. The specimen is not a good ore, and rather lean, containing only about twenty per cent of iron, and very silicious. But to me the specimen is suggestive. There must be a genuine ore somewhere in that region. This specimen is not an oxidized result of some nodule or mass of sulphide, which frequently occurs even in the blue limestone of this region and of other horizons where iron ore is not found. This is too silicious, and indicates an outcrop of magnetite or compact specular ore or red hematite. There seems, from the statement of the finder, to be a large number of fragments scattered around. I am somewhat acquainted with the country to the south, and there acres may be found covered with streaks and patches of extremely red soil, but this is the first specimen so nearly resembling iron ore that I have seen from this country.

"The particular interest associated with finding iron ore in this country is twofold. Geologically this land is Jurassic, or, of the higher horizon, Cretaceous, horizons in which it is not usual to find such ores as the ancients used from which to make iron, ores which were exclusively rich. Elba has no Jurassic formation, and its iron comes from Porto Ferraio, in a strictly plutonic region. Moreover, this land, historically, was spoken of as one from which iron could be taken, an assertion not yet verified. A discovery of true ore here would be scientifically and historically interesting, and I would suggest to tourists this summer to examine the region to the north and east of the locality above indicated for a true magnetite or specular ore (red), using the brown hematite specimens only as indications."

Grape Culture.

The following brief, practical, and condensed rules for the management of grapes were given by Dr. Whiting at the Farmers' Institute, recently held at Saginaw, Mich.:

The soil best suited for the grape is decomposing shale, but any good clay soil thoroughly drained will do.

The ground should be carefully prepared, and only well rotted manure used.

Decomposing turf is one of the best fertilizers; when it can be obtained, no other will be required.

The vines selected for planting should be good one year old layers or cuttings. They may look small, but will make the best vines.

Good culture is as necessary to the vine as to corn or cabbage.

Mulching and watering the first year should not be neglected if drought is excessive. One good soaking is better than many sprinklings. More water can be saved with a hoe than can be put on with a sprinkler.

In planting cut the vine back to two buds, whatever its strength or age.

Summer pruning consists in pinching off weak and straggling shoots in order to confine the sap to the main branches.

The first summer allow but one main shoot to grow. In the fall, after the first frost, cut all the summer growth back to within two buds of the ground.

The second year confine the sap to two branches, and in the fall cut back to three buds each.

The third year, if your vine has made vigorous growth, a few stems of grapes may be allowed to mature, but better take off all the fruit than to suffer too much to grow.

Too heavy bearing while young will weaken the vine for all future time. The trimming now depends on what kind of trellis you wish to cover.

After you have obtained a good vigorous root, you can make it grow in almost any place or shape you wish, by keeping the branches desired tied up, and all the others pinched back.

Each year a few of the strongest branches should be allowed to grow as bearers of fruit the following year.

In trimming cut away as much of the old wood as possible and save the new, as all the fruit buds are on the new wood.

You can easily tell how much to cut away by holding your new wood up to the trellis, and imagine a branch with three stems of grapes for each bud.

If you do not cut off enough in the fall, and you find that the vine is going to be too thick, do not fail to attend to it

when the new shoots are from three to six inches long, in the spring, or while in blossom. As soon as the fruit is set examine the vine; spread out the new wood so that each bunch of grapes will hang free and clear; pick off all the small stems of fruit, and fasten the vines securely, so that the wind will not destroy your crop by breaking the young and tender branches.

When the wood has grown so that there are three leaves beyond the last bunch of grapes examine the vine, select the branches you wish to save for fruit bearing the coming year, and keep them tied up until they have grown as long as you wish to make use of. The ends of the other bearing branches should be pinched off as soon as they reach this point, "three leaves beyond the last stem of grapes."

Break off all shoots and laterals as fast as they make their appearance, but on no account injure the leaves on the bearing canes.

The fruit will color but not ripen if the leaves are destroyed.

Grapes for fall and winter use should be picked as soon as ripe, and when perfectly dry, packed in fine dry sawdust. Select your box or jar, cover the bottom with sawdust, then layers of grapes and sawdust alternately until full. Keep them in the coolest place you can find free from frost, until wanted for use.

THE PRODUCTION OF ARTIFICIAL MONSTERS.

It is well known that both animals and plants often yield progeny of strange and abnormal form, sometimes changing the whole aspect of the offspring, at others appearing as greater or less deformities. "Sports," "freaks of nature," "monsters," and like names are popularly applied to these phenomena, despite the fact that science has succeeded in reducing certain types under definite laws. Most commonly

Fig. 1.

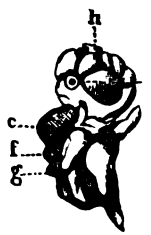


Fig. 2.



these organisms are sterile, but there are instances where they reproduce their kind and become a species. Geoffroy St. Hilaire, who perhaps made the deepest investigations ever conducted into the nature and causes of their production, first conceived the idea of artificially producing them, and to this end he began modifications of the physical conditions of the evolution of the chicken during natural and artificial incubation. He determined the fact that monsters could be produced in this way, but scarcely carried his investigation further. This work has been taken up by M. Dareste, and he has lately published a volume in Paris which recounts the results of a quarter of a century's experimenting. Eggs, he states, were submitted to incubation in a vertical instead of in a horizontal position; they were covered with varnish in certain places so as to stop or modify evaporation and respiration. The evolution of the chick was rendered slower by a temperature below that of the normal heat of incubation. Finally, eggs were warmed only at one point, so that the young animal, during development, was submitted at different parts to variable temperatures.

Fig. 3.



Fig. 4.



These perturbations resulted in the most curious and unlooked for deformities in the embryo, some being not alone peculiar to the bird, but being similar to those which have been recognized in many other animals, and even in the human species. The data obtained have been deemed so important that M. Dareste has recently received the Lacaze prize for physiology from the French Academy of Sciences.

It would be impossible, in the limited space at our disposal, to review even a fraction of the many forms of monstrosities which M. Dareste has discovered. Those that we give will, however, suffice to convey an idea of the wonderful variations produced. Fig. 1 is a chick embryo, with the encephalon entirely outside the head, the heart, liver, and gizzard outside the umbilical opening, right wing lifted up beside the head, and the development of the left one stopped. In Fig. 2 the encephalon is herniated and marked with blood spots, the eye is rudimentary and replaced by a spot of pigment, the upper beak is shorter than the lower one, while the heart, liver, etc., are all outside. In Figs. 3 and 4 the head is compressed, eyes well developed, but in

the back instead of in the sides of the head; the body is bent, abdominal intestines not closed, heart largely developed and herniated. The literal references to the foregoing are: *am*, amnion; *al*, allantois; *v*, vitellus; *h*, encephalon; *i*, eye; *c*, heart; *f*, liver; *g*, gizzard; *ms*, upper, and *mi*, lower member.

The commonest case of monstrosity observed by M. Dareste has been that of the head protruding from the navel, and the heart or hearts above the head. This is a most extraordinary and new monster, and, if it persist, a chicken

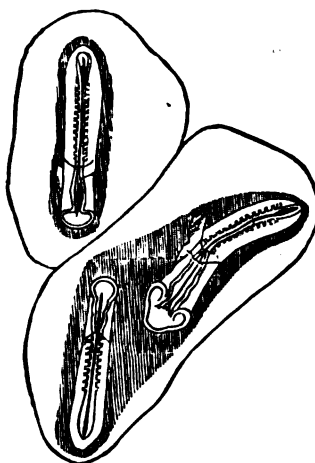
Fig. 5.



with its heart on its back, like a hump, may be expected. A curious fact discovered is the duplicity of the heart at the beginning of incubation, two hearts, beating separately, being clearly seen. Another anomaly consists in heads with a frontal swelling, which is filled by the cerebral hemispheres.

M. Dareste's artificial monsters are all produced from the single germ or cicatrice (as the white circular spot seen in the yellow of the egg, and from which the embryo springs, is termed). He has not yet been able to determine artificially the production of monsters, the origin of which takes place in a peculiar state of the cicatrice before incubation. But having submitted to incubation some 10,000 eggs he has obtained several remarkable examples of double monstrosities

Fig. 6.



in process of formation, some representations of which are given herewith. Fig. 5 shows three embryos, all derived from a single cicatrice. Fig. 6 represents three embryos from two cicatrices. On one side of the line of junction are two imperfectly developed embryos, one having no heart. The single embryo on the other side is generally normal, but has a heart on the right side. In Fig. 7 are twins, one well formed, the heart circulating colorless blood, the other having no heart and a rudimentary head. Fig. 8 exhibits a double monster with lateral union. The heads are separate, and there are three upper and three lower members, those of the latter on the median line belonging equally to each of the pair.

Fig. 7.

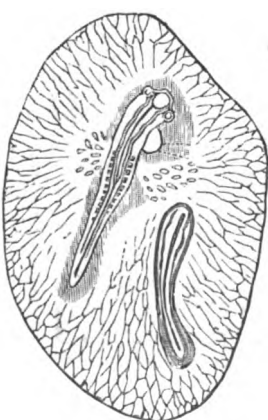


Fig. 8.



M. Dareste's work embodies a general theory of these singular organisms, which, it is believed, will be of much value to embryological science.

New Investigations on Glucinum.

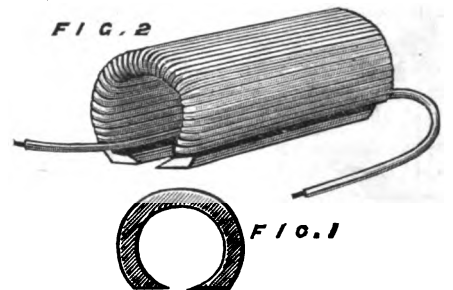
MM. Nilson and Petersson communicate to the French Academy of Sciences the following results of their late investigations into the physical properties and specific heat of glucinum: The metal is grayish, and of about the color of steel or tin. It is very light, has a density of 1.901 at 32° Fah., is hard, has a great tendency to crystallize, and when cast in globules breaks easily under the hammer. It does not fuse at temperatures at which sea salt easily melts, and is not altered by exposure to the air. It is unalterable by oxygen when at a red heat or by sulphur vapor. In the oxidizing flame it becomes covered with an oxide film, with no phenomena of ignition. It has no action on water, hot or cold. Hydrochloric and hydrosulphuric acids and hydrates of potash and soda are decomposed by it. It disengages hydrogen rapidly when heated. Nitric acid attacks it slowly, a small residue of silicic acid with a little iron and glucine resulting. The density of the impure metal has been determined at 1.9101. The specific heat averages 0.4084.

A Possible New Force in the Solar Rays.

M. Forssman, who has been making investigations on the action of variously colored lights on the galvanic conductivity of selenium, concludes that it is not the light vibrations or certain kinds of them that produce variations of conductive resistance, but vibrations of another order which he thinks have neither lighting, heating, nor chemical action. This opens the road to further researches to discover whether this hypothesis be true, as, if so, its verification would be of the highest scientific importance, and amount practically to the revelation of a new mode of motion.

How to make a Strong Electro-Magnet.

To make a Jamin magnet, take a piece of wrought iron pipe about 3 inches long by 1 inch diameter, file away one



side until through (see Fig. 1), and then, after softening it in fire, wind with cotton-covered wire in the direction of its length, as in Fig. 2. It is superior to the ordinary form of magnet in its great power, arising from several causes. The poles are close to one another, and have large surfaces, and, from their proximity, the part of the wire in the interior of the tube reacts on both poles, thus utilizing the battery power to the full.

A Salmon Disease.

A remarkable fatality has befallen the salmon in the rivers of Cumberland and Westmoreland, England. A short time ago large numbers of salmon were found dead on the banks or floating on the surface of the river Kent, and, though poisoning was suspected, the river watchers have been unable to find any trace of pollution, either willful or accidental. In most cases it was found that the fish were "kelts" or spawned fish, which had, as is frequently the case, succumbed to the effects of exhaustion after spawning; but the great number of fish dying in this way at one time was very remarkable. In the Eden, however, a more serious state of affairs exists. Large numbers of salmon—not only kelts, but clean fish lately arrived from the sea—appear to be affected with an epidemic which destroys hundreds of them. The head and tail first, and gradually the whole body, is attacked by a disease which appears to eat away the flesh, turning it white, and giving the fish the appearance of being affected with leprosy. Such fish are entirely unfit for food. Correspondents describe them as leaping out of the water, as if in pain, and in frantic efforts to escape; some return to the sea, but many perish in their attempts to reach the salt water. The salmon caught in the estuary are not diseased in this way, and, as the epidemic is said to be spreading to the trout, it would appear that some peculiar condition in the fresh water is the cause of the remarkable phenomena.

Improved Rolls for Beams.

Mr. Josef F. De Buigne, of Vienna, Austria, has recently patented a new method of grooving rolls, so that the groove forming the web of the beam or bar shall form an obtuse angle with the axis of the roll and with grooves which make the flanges. By this arrangement a vertical pressure is exerted at each pass at the same time upon the web and upon two of the opposite flanges, so that any desired sectional shape may be made by the use of horizontal rolls, only independent of the relative dimensions of flanges and web. The patent is offered for sale by Messrs. Wirth & Co., of Frankfurt-on-the-Main, Germany.

A NEW EXPLOSIVE.—Professor Emerson Reynolds suggests a compound of 75 parts chlorate of potash and 25 parts sulphurea (a substance obtained from a waste product of gas manufacture), the ingredients to be mixed as required at the time of using.

M. PLANTE'S NEW INVESTIGATIONS ON THE EFFECTS OF HIGH TENSION CURRENTS.

We have already noted several of the more important electrical phenomena observed by M. Planté by the aid of the powerful discharges of his secondary batteries. In the annexed engravings, which we extract from *La Nature*, are represented the apparatus he uses, and some new and interesting effects of the current. Fig. 1 shows the disposition of 400 secondary elements, divided into ten batteries of forty couples each. In his recent experiments with eight hundred secondary couples, another series of batteries is placed in an adjoining room, and all the batteries are suitably connected. To charge them, two to four Bunsen couples suffice, the latter being placed outside the room to avoid the effects of acid emanations. When the batteries have not rested inoperative too long, a few hours are sufficient to charge them. Then, by adjusting the commutators, the elements previously connected for quantity may be adjusted for tension, so as to expend either in a few seconds or a longer period, at the will of the operator, the large quantity of electricity resulting from the chemical action accumulated during several hours by the Bunsen couples.

The experiments have most frequently been made in the dark, so that the details of the luminous phenomena may be studied. The voltmeter is represented at the moment when the electric current acts at its surface. Steam is seen rising, due to the powerful calorific effect.

One of the most remarkable phenomena recently observed by M. Planté relates to the electric silicic light, regarding which we have already made some brief mention. If in a solution of nitrate of potash a platinum wire (inclosed in a glass tube and connected with a secondary battery of sixty elements) be placed, the pole of the battery being previously immersed, the glass melts at the end of the tube and expands with a brilliant light. The end of the wire becomes enveloped in a globe of melted glass (Fig. 2), and the light shines brilliantly while the discharge continues, until the glass, melting and cooling around the electrode, isolates it completely from the liquid. When a solution of sea salt is used in the voltame-

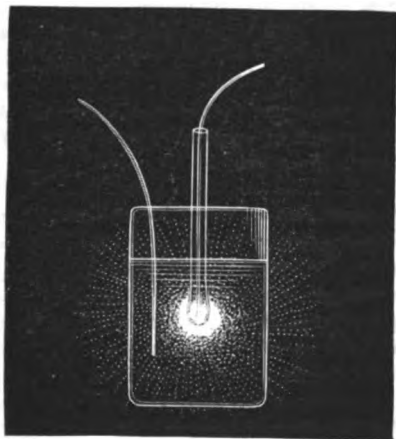


Fig. 2.

ter, from two hundred and fifty to three hundred secondary couples are required to give the same effect. The saltpeter solution enables the result to be obtained with a much weaker current.

The peculiar vitreous light may be produced by applying either electrode against a plate of glass a little distance above the saline solution (Fig. 3). It is accompanied by a disengagement of white vapors, and the glass is strongly attacked. The same illumination may be produced along the sides of a porcelain cup. It seems probable that the brilliancy of the light may be attributed to the lime combining with the silicic in the glass; but if, on the other hand, its spectrum be examined no appreciable lines are to be found. Nevertheless a fragment of calc spar, placed under the same conditions, gives a brilliant light and exhibits the characteristic calcium lines. The silicium lines being weak, they may not appear by reason of the luminous intensity of the spectrum formed; but the silicic origin of the light is demonstrated by the important fact that it appears on the contact of the electrode with pure silicic in the state of hyaline quartz, Fig. 4.

While conducting these experiments M. Planté observed that the luminous rings formed around the positive electrode of a powerful battery sometimes remained engraved on the surface of the glass voltmeter. This led him to attempt to utilize the electric current as a means of engraving glass plates. The glass is covered with a saltpeter solution, and in this is plunged (along the sides of the plate) a platinum wire

communicating with a fifty or sixty element secondary battery. The other electrode is also of platinum, covered with isolating material except at its extremity, and this is used to touch the glass wherever the design is to be engraved. The work is done with great rapidity and delicacy, and remarkably fine lines are produced to any desired depth.

Natural History Notes.

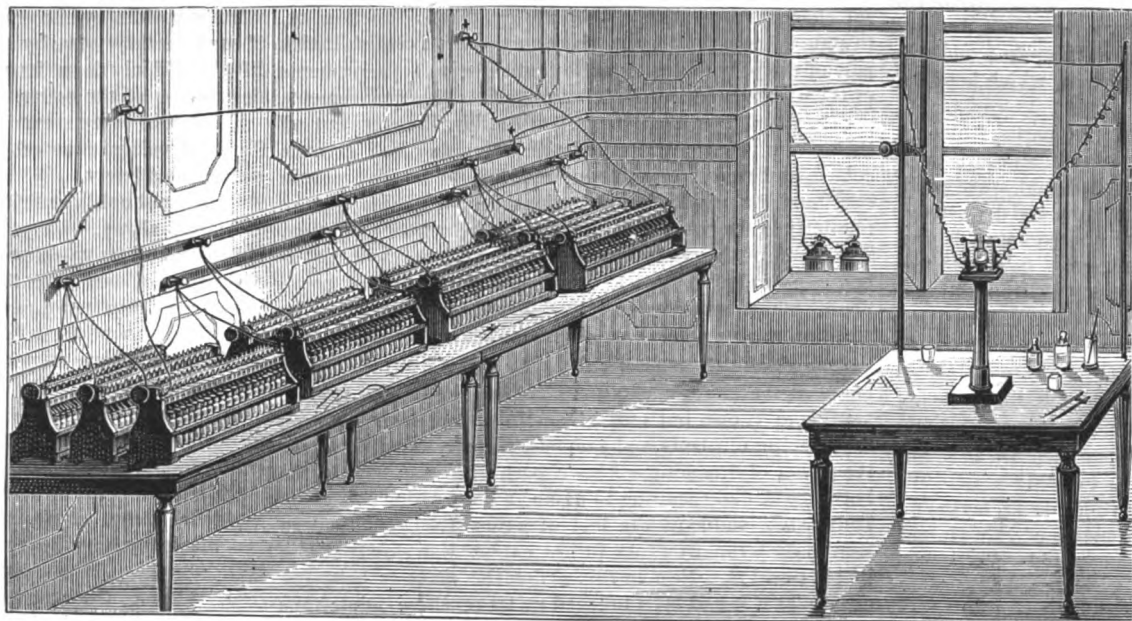
Poison of Snakes.—The *Transactions of the Royal Society* contain a paper by Mr. Pedler, in which he publishes the results of his elaborate experiments on snake poison, which had for their object the discovery of an antidote, but which were unsuccessful. Ammonia, as an antidote for application to the wound, he has proved to be utterly worth-

hatred of strangers. They are guided more by scent than by sight in following up tracks of food which has been shifted in position after they have once partaken of it, returned to their nest, and then again sallied forth in search of it. They avoid light when it is thrown into their nest, and congregate in the darkest corners. Taking advantage of this habit, and by a series of ingeniously contrived experiments, wherein strips of colored glass and shallow cells containing colored solutions—such as fuchsine, bichromate of potash, chloride of copper, etc.—were used, Sir John arrives at the conclusion that ants, like bees, are influenced by the sensation of color, though in the case of ants its effects, probably, are different from those produced on the retina of man. In the ants experimented upon, a marked preference was given by

them to red; green followed, yellow came next, while to blue they appear to have a decided aversion. The longevity of these insects from these series of observations would appear to be greater than most authors admit; for some specimens in the experimenter's possession are now at least five years old and still lively.

The "Rain Tree" of Moyobamba.—A paragraph has been going the rounds of the papers describing, on the authority of the United States Consul in the province of Loreto, a tree existing in the forests near Moyobamba, in northern Peru. This tree was stated to absorb and condense the humidity of the atmosphere with such astonishing energy that the water may frequently be seen to ooze from its trunk and fall in rain from its branches in such quantities that the ground be-

Fig. 1. PLANTE'S SECONDARY BATTERIES.



neath was converted into a perfect swamp. Mr. Thiselton Dyer, the botanist, has investigated the subject, and in a short paper read before the Linnæan Society gives it as his opinion, based on information derived from Mr. Spruce, that the "rain tree" (*Tamia-caspi* of the natives) is the *Pithecolobium samar* of botanists, and the so-called "rain" the fluid excreta of young cicadas, which they squirt forth in slender streams as they feed on the juices of the foliage. The whole phenomenon is comparable to the production of honey dew from the lime by the agency of plant lice (*aphides*).

Sophora Speciosa.—This leguminous plant, a native of Texas, has recently attracted the attention of botanists on account of its poisonous seeds—a character very unusual, if not entirely unknown, in any other plant of the large order to which it belongs, an order that furnishes us with the pea and bean and some other nutritious foods. The seeds of the plant have been described by Mr. Bullock at a meeting of the American Pharmaceutical Society. Professor H. Wood, Jr., has analyzed them, and detected what is apparently a new alkaloid, for which he proposes the name of *sophoria*. Half of one of the seeds is said to be sufficient to produce delicious exhilaration, followed by a sleep lasting one or two days.

Habits of Ants.—Sir John Lubbock continues his observations and experiments; he finds that ants recognize old acquaintances and speedily attack strangers. He doubts their vaunted intelligence, for example, in cases where a thin circle of glycerin bars their access to honey which they have already visited by a paper bridge; for, when the latter is taken away, they do not go to work and pile up grains of the surrounding earth (as they might do) and thus easily cross the glycerin barrier. Notwithstanding the many observers of the habits of ants, and the plentifulness of their nests, it is still doubtful how the latter are commenced. As to these insects intimating to each other their discovery of food, this does not necessarily imply any power of describing localities, for it seems that co-workers accompany each other to the discovered treas-



Fig. 3.

Effect of Growing Plants on the Air.—In a recent article, the eminent sanitarian, Professor Von Pettenkofer, of Munich, argues, from data collected by himself and others, that there is no superabundance of oxygen in the vicinity of growing vegetation; and that, as a matter of fact, so far as the supply of this gas is concerned, the country, with its boasted superiority, is not much better off than the city. This is quite the contrary of what has usually been taught.

A Self-fertilizing Cabbage.—Dr. Francis Darwin, in a recent lecture, says that "it is curious to find a plant adopting a new mode of conveying its pollen when the old one fails. Thus, a wild cabbage-like plant which grows in Kerguelen's Land is now fertilized by the wind; that is, it produces dry, dust-like pollen, which is easily carried by the wind. Now, this cabbage is the only species in the enormous order of the *Crucifera* which is not fertilized by insects; so that we may be certain that some change has taken place for which good reasons exist. And the reason of the change is, no doubt, that the insects in Kerguelen's Land are wingless, and therefore bad distributors of pollen. And, to go one step further back, the reason why the insects are wingless is to be found in the prevalent high winds. Those insects which attempt to fly get blown out to sea, and only those are preserved which are gradually giving up the habit of flying. Thus the pollen of the cabbage has to learn to fly because the insects will not fly for it."

Protective Mimicry in Caterpillars.—At a recent meeting of the British Entomological Society, Sir John Lubbock read a



Fig. 4.

ure rather by a simpler sign. Experiments, again, seem to negative the idea of these insects using sounds to acquaint their fellows of any repast they may come across. As to the affection of ants for their friends, this is outbalanced by their

paper on the coloring of British caterpillars. Accepting the theory laid down by Darwin and others, that dull colored, green, and smooth skinned caterpillars are eaten by birds, etc., while spiny, hairy, and brightly colored species are rejected, the author stated that, by the statistical method, it was shown that no hairy caterpillars are green; while, on the other hand, a large majority of black and brightly colored species are hairy or otherwise protected.

Danger from Cats.—A writer in the *Lancet* states that it is a mistake to suppose that there is no danger in the bite or scratch of one of these animals. There have been abundant and melancholy proofs of the peril of contracting hydrophobia from cats; and the danger is scarcely less than that which attends an injury inflicted by a dog.

A New Method of Preserving the Colors of Dried Plants.—It is pretty well known that plants treated with alcohol can have their natural colors preserved for a long time; but still they begin to fade far too soon and darken. To avoid this, resort may be had to the following process, which is said to yield excellent results:

Dissolve one part of salicylic acid in 600 parts of alcohol, and heat the solution to the boiling point in an evaporating dish. Draw the plant slowly through the liquid, wave gently in the air to get rid of superfluous moisture, and dry between folds of blotting paper several times repeated. In this manner the plants dry rapidly, which is a great gain, and they thus furnish specimens of superior beauty. The addition of a drachm of red Condyl's fluid to the water contained in a flower vase will preserve the freshness of cut specimens for three or four days.

A Gardener Bird.—Under this title the *Gardener's Chronicle* gives a description, with illustrative woodcuts from original sketches drawn on the spot by Signor Beccari, of a bird which is not only an expert architect—building a nest like the bower bird of Australia—but also a gardener, laying out a garden in front of it. The bird is a native of New Guinea, and makes its nest of the stems of an orchid. In front of the nest a dressed lawn of moss is formed, on which the attentive male places, day by day, for the delectation of his mate, flowers and fruits of bright colors and pleasing flavor. The orchid, which belongs to a hitherto unknown species, has been described in full by Professor Reichenbach.

"Protective Resemblances" in Fungi.—The eminent authority on mushrooms and toadstools, Mr. Worthington G. Smith, figures and describes, in a recent number of the *Gardener's Chronicle*, specimens of a toadstool (*Agaricus furfuraceus*) which had assumed the habit of a morel (*Morchella*). There is no doubt that these plants, which were first thought to be morels, are true specimens of *Agaricus furfuraceus*, for Mr. Smith mentions that many intermediate forms were found associated. There have recently been found many specimens of toadstools with the habit of other species, and they have generally been accounted for on the somewhat fanciful supposition of "protective resemblance;" but, unfortunately for this theory, most of the cases have been of poisonous species taking the habit of edible ones. In this case, as Mr. Smith points out, there would be little advantage to *Agaricus furfuraceus* in assuming the habit of the much sought after edible morel; there would certainly be just as little to an unskillful collector.

The Oaks of the United States.—In 1876, Dr. Englemann, after a study of the oaks of the United States, read a paper on the subject before the St. Louis Academy of Sciences, giving as the results of his investigations an entire revision of this extensive and perplexing genus. In a subsequent paper published in the *Proceedings of the Academy*, he has corrected some errors and modified his former arrangement of the genus.

The collection of oaks at the Centennial Exhibition furnished interesting facts. The black oaks grow, on an average, twice as fast as the white oaks. The heartwood of the latter is always readily distinguishable, but that of the black oaks is scarcely, if at all, darker than the sapwood. The black oaks of the present day are confined to America, principally to the Atlantic region, but in the Tertiary period they extended into the Old World. Occasionally black oaks are found with cup scales thickened at the base. Professor Sargent has collected, near Cambridge, acorns of scrub oak (*Quercus ilicifolia*), whose cups had this peculiarity, and it does not seem to be rare at all in the northern forms of red oak.

As what are considered hybrid oaks are abundantly fertile, and their acorns capable of germinating, the only test is the rarity and individuality of the form, and its character intermediate between two well established species which occur in the neighborhood. Hybrids seem to be much rarer between white oaks than among black oaks; or it may be that they are more difficult to discover. Dr. Englemann knows of only three, all of them pointing to the white oak (*Q. alba*) as one of the parents. Of black oaks he names seven hybrids, one of them, between the scarlet oak and the willow oak, being Bartram's oak (*Q. heterophylla*). He was formerly inclined to believe the latter to be a distinct species. The type specimen of Michaux was long ago destroyed, but within the last ten or fifteen years the tree has been rediscovered; and now numbers of individuals are known in low woods on both sides of the Delaware, below Philadelphia, often in groups together, probably the offspring of some few original hybrid trees.

The Jelly Fish.—The jelly fish have at length been shown to possess a nervous system, a point which had been considered doubtful; and one that was difficult to demonstrate on account of the gelatinous and deliquescent nature of the

fish, which rendered microscopic examination almost impossible.

Ehrenberg had, indeed, asserted the fact, but Escholtz and others had failed to discover any traces of nerves in the largest jelly fish examined. Mr. Romanes, in a second communication to the Linnean Society on this subject, has thrown a flood of light on the first beginnings in the animal kingdom. By a series of physiological researches, the microscope being only used as an auxiliary instead of being solely relied on, as by former inquirers, he has succeeded in proving satisfactorily that the jelly fish, or *Medusida*, have a nervous system. In view of the latter fact his experiments were perhaps hardly as satisfactory to the jelly fish selected for experimenting on as to himself and the scientific world. Every one knows, at least from engravings, the umbrella or mushroom form of the jelly fish. The stem part, it appears, has no tissue elements possessing a properly ganglionic function, or, to state it less scientifically, there are no nerve centers in this part of the jelly fish to exercise control over the movements of the umbrella part or swimming bell. These movements are regulated from the margin. When Mr. Romanes cut off the margin, the pulsations of the swimming bell at once ceased, and were not again renewed; but the severed margin continued its rhythmical pulsations for some time, and as regularly as the entire bell had pulsated before the operation. The whole of the muscular sheet which lines the cavity of the bell is pervaded, it seems, by a dense meshwork of nerve fibers, which serve to carry ganglionic impulses from the margin over the whole expanse of the muscular sheet.

Dreaming of Plants.—Dr. Francis Darwin, in his recent paper on the analogy between plant and animal life, says:

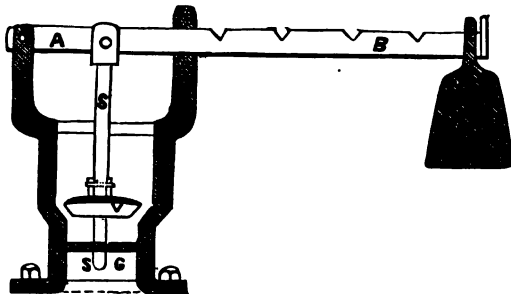
"There is one, but only a fanciful resemblance between the sleeping of plants and animals, namely, that both have the power of dreaming. I have been sitting quietly in the hothouse at night waiting to make an observation at a given hour, when suddenly the leaf of a sensitive plant has been seen to drop rapidly to its fullest extent and slowly rise to its old position. Now in this action the plant is behaving exactly as if it had been touched on its sensitive joint; thus some internal process produces the same impression on the plant as a real external stimulus. In the same way a dog dreaming by the fire will yelp and move his legs as if he were hunting a real instead of an imaginary rabbit."

Purple Oysters.—Last autumn the oysters in the Bay of Arcachon (France) acquired a very remarkable violet color. M. Descoust finds that this coloration is due to the presence in the oyster basin of large quantities of one of the rhodospERM seaweeds (*Rhytiphlea tinctoria*), the spores of which are very highly colored. He finds that the coloring matter of these spores is assimilated by the oysters, and retained by them, more or less modified, in the lobes of the mantle and the branchiæ, and that they cannot get rid of it unless the water of the oyster parks is sufficiently diluted by rains. Last summer the drought was extreme all about the basin of Arcachon; hence the oysters became gorged with the coloring matter, the water of the parks not being sufficiently diluted to dissolve the latter.

Silk from Mussels.—A German naturalist, Tulberg, suggests the industrial application of the products of the mussel. The well known *bysus*, or strong silky threads which these animals spin in order to fasten themselves to rocks and stones, is pointed out as a probable raw material to rival the somewhat similar threads spun by the silkworm. The threads of the *pinna*, a mollusk allied to the mussel, have been worked into fine fabrics and made into gloves, and have, for a long time, been in common use among the poorer class of girls and women in Italy for such purposes. The toughness of the *bysus* of the mussel is a strong recommendation in favor of its adaptation to some such use.

The Safety Valve.

The form and construction of the indispensable adjunct to the steam boiler illustrated herewith are of the highest importance, not only for the preservation of life and pro-



erty, which would in the absence of this means of safety be constantly jeopardized, but also to secure the durability of the steam boiler itself. B is the lever; A, short arm of lever; S S, stem; V, valve; G, guide; W, weight.

Increasing the pressure to a dangerous degree would be impossible in any boiler, if the safety valve were what it is supposed to be—a perfect means for liberating all the steam which a boiler may produce with the fires in full blast, and all other means for the escape of steam closed. Until such a safety valve shall be devised and adopted in general use, safety from gradually increasing pressure must depend on the attention and watchfulness of the engineer.

We have decidedly too much theory on the safety valve, and most of this theory is the merest vagary, which it is impossible to harmonize with experience and sound practice.

All that the safety valve needs to make it what it was intended to be, is, first, an orifice proportioned to the grate surface; second, simplicity of construction; third, directness of action.

Q. What is the object or use of the safety valve? A. It is a valve intended to relieve the boiler from extra pressure, and to prevent bursting, collapse, or explosion.

Q. What do you consider a proper proportion for the safety valve of a boiler? A. The area of the safety valve should be one half square inch to each square foot of grate surface.

Q. Will this amount of opening of safety valve be safe for any ordinary pressure? A. Yes; it will be safe for any pressure from 10 pounds to the square inch up to 100 pounds.

Q. Is an enlargement of the safety valve greatly beyond what is customary in common practice dangerous? A. Yes; if such a safety valve by any accident should be knocked or lifted suddenly from its seat, it would probably cause the destruction of the boiler.

Q. Should every steam boiler have two safety valves? A. No; one safety valve of suitable proportions, and in good order, is sufficient.

Q. How should the safety valve be kept or cared for? A. It should always be kept as free as possible from dust and ashes, and all its working parts in good order.

Q. How often should the safety valve be moved? A. At least once a day, more particularly in the morning.

Q. Why should the safety valve be moved in the morning? A. So as to be sure that it is in good working order before starting the fire.

Q. What are the most important principles to be adhered to in the construction of the safety valve? A. Simplicity of construction, directness, and freedom of action.

Q. Does the safety valve become worn and leaky by the continual action of the steam? A. Yes; all safety valves become leaky, and ought to be ground carefully on their seats.

Q. What is the best material to use for grinding safety valves? A. Pulverized glass, grit of grinding stones, or fine emery.

Q. Should safety valves be constructed with loose or vibratory stems? A. Yes; as the rigid or solid stem is apt to become jammed by the canting of the lever and weight, and in such cases the higher the pressure the more difficult is the action of the valve.

Q. Is the marking on safety valves sometimes incorrect? A. Yes; decidedly so.

Q. How can you tell whether the safety valve lever is marked correctly or not? A. By calculation.

Q. How do you square a diameter? A. Any diameter multiplied by itself is squared; as, for instance, 10 squared equals 100.

Q. Why do you multiply the square by 0.7854? A. By squaring the diameter we get square inches, and if we multiply by 0.7854, we get circular inches.

Q. What is the difference between circular and square inches? A. A circular inch is 0.7854 part of the square inch.

Q. What do you mean by the word "area"? A. By area we mean the amount of surface exposed to the action of the steam.—*Roper's Hand Book*.

Phosphorus as Food for the Intellect.

In an article on the "Hygiene of Chronic Nervous Diseases," read by Dr. G. M. Beard before the Kings County Medical Society, the author says: Although the generalization of Agassiz, that fish feeds the intellect, is among the wildest and most unscientific ever made, yet there is little doubt that the so-called "sea food," fish and oysters, is excellent for the nervous system, and very likely in part by virtue of the phosphorus it contains; but it no more feeds the intellect than phosphorus given in any other way. A healthy brain and an intellectual brain are not synonymous. One may be perfectly well, and, at the same time, perfectly stupid; a fool may eat like a lower animal, while the great philosopher barely keeps himself alive. While food is essential to thought, yet the force in food is not converted into thought-force. Good thinkers, like good athletes, are usually liberal feeders; but thousands who eat as much or more have very little intellect or muscle. The effect of a diet largely of fish seems to be sedative, calmative, like that of bromide of potassium, or phosphorus, or electricity—like these remedies, producing dullness rather than intellectuality, and inducing a disposition to sleep more than to think; not accelerating but slowing down the wheels of the mind, and therefore excellent and adapted for the nervous, and overworked, and over-worried. The mistake of Agassiz was analogous to the mistake of the Italian physician, Paggioli, who used electricity on the brains of children, in order to stimulate their intellects and help them get their lessons and take the first prizes in school.

The Late Mr. A. T. Stewart.

The millionaire, once came to the conclusion that, although advertising was a good thing as a ladder, it was of no great benefit to him, as his name sold the goods. As a test, one department only of his establishment was advertised. Its business overtopped that of the others so immediately and so largely, that Mr. Stewart concluded that to get the full power of his name it must appear in printer's ink. His advertising managers say, "from that time he advertised more largely than ever in the papers."

The Opening of the Paris Exposition.

The International Exposition of 1878 in Paris was formally opened on May 1, with the usual ceremonies attending such events. President MacMahon, accompanied by the Prince of Wales, the Prince of Orange, and many other royal personages, was received by the Minister of Commerce, amid the salutes of a large body of soldiers. The Minister delivered an address, in which he thanked the foreign countries which had responded to the appeal of France for contributions of manufactures and art treasures. President MacMahon then pronounced the Exposition open, when the fountains were opened, salutes were fired, and the flags on the buildings were hoisted. The distinguished party made a tour of the various edifices, and was received in the American section by Commissioner McCormick and a company of United States marines.

According to all accounts the show is in a very backward state. In the Swiss, Chinese, Japanese, and Russian sections most progress has been made and a fine exhibit will be displayed; but it is said that no contribution will compare with that of England and her colonies.

The New York *Tribune's* correspondent, with regard to the merit of our American display as compared with the exhibits of other nations, says that "the question can be answered better a month hence than now; but one or two things are as clear now as they will ever be. Our section is next to the British; how do the two compare? The British section is about six times as big as the American, filling quite one fourth of the whole building assigned to the non-French part of the world. We are about half as large as Belgium, two thirds as large as Austria, a little less than China and Japan together, about on a level with Russia, with Italy, and with Switzerland. We are slightly larger than the Netherlands. We occupy nearly twice the space that South America fills, but South America, re-enforced by Denmark and Greece, which are alongside, covers as much ground as the United States of North America.

"This is a rough, and, if you like, a vulgar method of comparison, but it is one a good many people will make. We have, moreover, a reputation in Europe for valuing mere bigness more than other nations, and if that be our standard, and we are to be judged by it, we certainly do not stand well. Our only chance is to surpass other nations in the general excellence of our modest contributions; to surpass them in variety, in sound workmanship, in finish, in novelty of invention, in the practical usefulness of the things we show. Perhaps we shall, but what I said about the hurry in which our things have been got together, and the utter refusal of many great houses to contribute, hardly looks like it. We shall fill all the space we have, and fill most of it well, I do not doubt. But the American who expects his country to stand anything like as well here as we did in Philadelphia, will be disappointed. To take one or two examples in a single department, that of machinery, we shall have not a single large printing press, but two sewing machines, and but one collection of machine tools, that of the Brown & Sharp Manufacturing Company, of Providence, R. I. One is almost tempted to say we had better not have come here at all than come with such a meager display. It should be understood that we could have had as much space as Great Britain if we had applied for it."

A Great Flour Mill Explosion.

A terrific flouring mill explosion occurred on the evening of May 2, in Minneapolis, Minn., which involved five mills adjoining the one in which the disaster originated, together with other buildings, and caused a loss estimated at a million dollars, besides the destruction of nearly a score of lives. The cause of the casualty is ascribed to an explosion of gas in the middlings purifiers, and also to the sudden combustion of the fine dust which pervaded all parts of the establishment. This last seems to have been the most likely cause. It is now well known that many substances, such as coal dust, saw dust, starch, and flour, when suspended in the atmosphere, in a finely comminuted state, are highly explosive, and in flouring mills especially there are numerous instances on record where sparks from the stones have ignited this dust, and produced all the effect of a gunpowder explosion. In such cases, however, it is always difficult to determine accurately the true cause of the accident, and the same, as in the example of the recent candy manufactory explosion in Barclay street in this city (probably due to ignition of fine starch), is thus left in doubt or ascribed to spontaneous combustion. The curious feature of this Minneapolis calamity is the successive explosion of a number of mills, the blowing up of the first acting upon the others, it would appear, not merely by communication of flames, but by concussion, as sometimes is true of gunpowder mills. Further details of the disaster will perhaps shed more light on this point; but it is none the less certain that improved safeguards against dust explosions might well engage the attention of inventors.

Opening of a New Elevated Steam Railway in New York City.

The first trip over the "Gilbert" Elevated Railway from Trinity Church to Central Park, in this city, was made on April 30th. The train consisted of a locomotive and four cars containing some 200 passengers. The speed, at first slow, was gradually increased to about 25 miles an hour, and the terminus in Fifty-ninth street was reached in 17 minutes. It is expected that the same distance will ordinarily be run by through trains in 13 minutes, and by way trains in

23 minutes. A failure in steam caused a delay on the return journey which occupied 32 minutes. The curves were passed easily and without jarring, and over the entire line the motion was smooth and uniform.

The new passenger cars are 37 feet 10 inches in length by 8 feet 9 inches in width, and will accommodate 48 persons each. The doors are placed at the ends, but it is intended that some of the vehicles shall be fitted with compartments. The decorations inside and out are very tasteful, and the unusually large windows will render the cars airy and comfortable for summer travel. The passage of the trial train was received with much enthusiasm by people along the route. Several trains have run over the road carrying passengers, but operations will probably not be regularly begun until the completion of the stations, now in rapid process of erection.

The Gilbert elevated road, it will be remembered, is a huge iron bridge, which, so far as completed, extends from Morris street along New Church to Church street, thence along Murray street, College place, and Chambers street to West Broadway, which it follows until it crosses Canal street and enters upon South Fifth avenue. Along this thoroughfare and West Third street, into which it turns, the road obscures the lower stories of buildings and works a great injury to private property, for which the owners receive no compensation. After leaving West Third street it turns into the splendid street known as Sixth avenue, and straddles the car tracks on that street up to Central Park at Fifty-ninth street. The distance is about 4½ miles. With the east side division, on which work has not yet begun, the total length of the line will be 22 miles, occupying and disfiguring the finest avenues in New York city.

The Natural Dissemination of Gold.

The results of recent investigations only go to confirm more and more the opinion long held by geologists as to the wide distribution of gold.

Mr. Henry G. Hanks, in a paper read by him before the California State Geological Society, on the "Divisibility of Gold" (see SCIENTIFIC AMERICAN SUPPLEMENT, No. 118), has recently added, as the result of his personal observations, many valuable facts in addition to what was already known on the subject, all tending to give further evidence as to the omnipresence of the precious metal in the earth's crust.

Of all the interesting examinations that have thus far been made to obtain information on this subject, the most curious, perhaps, were those that followed the investigations of Mr. Eckfeldt, the principal assayer of the United States mint at Philadelphia, a few years ago.

Underneath the paved city of Philadelphia there lies a deposit of clay whose area, by a probable estimate, would measure over three miles square, enabling us to figure out the convenient sum of ten square miles. The average depth is believed to be not less than fifteen feet. The inquiry was started whether gold was diffused in this earthy bed. From a central locality, which might afford a fair assay for the whole, the cellar of the new market, in Market street, near Eleventh street, some of the clay was dug out at a depth of fourteen feet, where it could not have been an artificial deposit. The weight of 130 grammes was dried and duly treated, and yielded one eighth of a milligramme of gold—a very decided quantity on a fine assay balance.

It was afterwards ascertained that the clay in its natural state loses about fifteen per cent of moisture in drying. So that, as it lies in the ground, the clay contains one part gold in 1,224,000. This experiment was repeated upon clay taken from a brickyard in the suburbs of the city, with the same result.

In order to calculate with some accuracy this body of wealth, blocks of clay were cut out, and a cubic foot (as it lies in the ground) found to weigh 120 pounds, nearly, making the specific gravity 1.92. The assay gave seven tenths of a grain of gold to the cubic foot. Assuming the data already given, it was ascertained that there were 4,180 millions of cubic feet of clay under the streets and houses, in which securely lay 126 millions of dollars; and if, as was pretty certain, the corporate limits of the city afforded eight times this bulk of clay, more gold lay therein than had as yet been brought from California and Australia.

From these figures it is apparent that, every time a cart load of clay is hauled out of a cellar, enough gold goes with it to pay for the carting; and, according to Mr. Eckfeldt's calculation, if the bricks which front the houses of the city could have brought to their surface, in the form of gold leaf, the amount of gold which they contain, there would appear a glittering star of two square inches on every brick.

The Total Eclipse of the Sun.

On the 29th of July next a total eclipse of the sun takes place under such circumstances as to present opportunities that occur scarcely once in a generation, for the study of some of the most interesting phenomena with which astronomers have to do. The path of the totality of this eclipse runs diagonally across the center of the United States from Montana to Texas, and is somewhere about 140 miles wide. Many of the best points for observing the eclipse are therefore directly accessible by railroad, and several expeditions might be sent out fully equipped to as many different points, without spending so much money upon them all as it would ordinarily take to equip a single expedition to a more distant point.

Recent discoveries have rendered it probable that most of the meteorological changes in progress upon this planet are

caused by events taking place upon the sun, and many questions relating to the physical constitution of that orb, and the changes there taking place, can only be studied during a total eclipse. It is said by Admiral Rodgers, of the Naval Observatory, that the sum of the opportunities which all the astronomers of the world can get for observing such eclipses does not exceed five or six hours in a century, and it is therefore important that every advantage should be taken of the very favorable conditions for observation under which the present eclipse occurs. All the principal European governments recognize the importance of studying the phenomena attendant upon the total eclipses, and send out costly expeditions, even to their antipodes when necessary, for this purpose; and there is no doubt that there is a general impression abroad that our government would make ample provision for the study of a matter of such general interest, that is visible almost exclusively within our borders, or the different foreign governments would no doubt be preparing to organize expeditions for observation on our territory. Our government, however, has so far done nothing, and it is possible that one of the best opportunities that may occur in many years for the study of solar phenomena may pass away without any advantage being taken of it.

The Naval Observatory is awake to the importance of the occasion, and has asked Congress for an appropriation of \$8,000 for the purpose of sending off seven expeditions, two of which it is designed to send to Montana, two to Texas, two to Colorado, and one to Wyoming, each to consist of three astronomers. The sum asked for was simply to pay traveling expenses and the cost of transporting and setting up the instruments in their temporary observatories, nothing being requested for salaries, as the most eminent astronomers will gladly volunteer their services for such an important occasion.

Petroleum Tanks.

Dr. Stevenson Macadam states that a lead tank will spoil the oil in a week, causing it, when burnt, to choke the wick so that the latter has to be trimmed several times in an evening. If the lead be bright the oil will be spoilt in a day. An iron tank does not much damage the oil for illuminating purposes, but it darkens the color rather considerably, and causes it to throw down a rusty-colored deposit. Zinc, ordinary tin solder, and galvanized iron, all spoil the oil. If a metallic tank must be used, let it be made of tin, copper, or tinned copper, and be sure that no common solder containing lead is used in making it. These metals do not seriously damage the oil, but if it be left in contact with them for some months, it will somewhat deteriorate. Stoneware or slate is suggested as being superior to any metal that can be used for petroleum tank making.

Singular Effect of Lightning.

Les Mondes notes a curious instance of where lightning striking frequently at the same point has gradually killed vegetation over a considerable area in the vicinity. The current after entering the earth made a deep hole some four inches in diameter. For some reason repeated strokes, during the last five or six years, have fallen at this point, and every year the circle of dead currant bushes around it has widened. At present the affected area has a diameter of over 20 feet, and a large cherry tree some twelve years old recently died. Fresh hardy bushes and shrubs planted within the boundary die within two years. It would seem that the lightning strokes have some influence in thus destroying vegetation, possibly by producing in the soil chemical compounds injurious to plants.

To Color Photographs.

Take a strongly printed photograph on paper, and saturate it from the back with a rag dipped in castor oil. Carefully rub off all excess from the surface after obtaining thorough transparency. Take a piece of glass an inch larger all round than the print, pour upon it dilute gelatin, and then "squeeze" the print and glass together. Allow it to dry, and then work in artist's oil colors from the back until you get the proper effect from the front. Both landscapes and portraits can be effectively colored by the above method without any great skill being required.

Cinders in the Eye.

To the Editor of the Scientific American:

Having noticed two communications in your journal lately under the above heading, permit me to give you a very simple remedy I have used for years with success: A small camel's hair brush dipped in water and passed over the ball of the eye on raising the lid. The operation requires no skill, takes but a moment, and instantly removes any cinder or particle of dust or dirt without inflaming the eye.

C. G. E.

New Binoxide of Manganese Element.

M. GaiFFE has recently made a new galvanic element, which consists of a carbon cylinder, perforated with numerous holes, in which grains of binoxide of manganese are placed, and a rod of amalgamated zinc. The liquid is a 20 per cent solution of neutral zinc chloride, free from lead. Oxide of zinc is formed, which falls in pulverulent state to the bottom of the containing vessel.

A HUGE BALLOON.—The dimensions of M. Giffard's captive balloon, which is being constructed in Paris, are 180 feet by 118 feet. The car will contain fifty persons, and the cable will be about 2,000 feet long.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

The Buckeye Engine Co. make a specialty of fitting plain engines with their Automatic Cut-off and Condensers: 30 to 60 per cent economy and perfect governing guaranteed. 87 Liberty St., N. Y.

Vertical Scientific Grain Mills. A. W. Stranb & Co., Phila.

For Town and Village use, comb'd Hand Fire Engine & Hose Carriage, \$350. Forsyth & Co., Manchester, N. H.

Bristol Machine Works For Sale. Facilities for all kinds of work. For full particulars, address Bristol Machine Works, Bristol, Pa.

Climax Washing Machine. Reliable Agents wanted. Descriptive circulars furnished. N. C. Baughman & Co., York, Pa.

The great Wheelock Engine, which furnishes the power to the machinery of the American Exhibit at the Paris Exposition this year, is lubricated by Patent Lubricene and Cups. Our exhibit will equal that which we made in Philadelphia in 1876. R. J. Chard, 124 M. Lane, N. Y. city.

Wanted.—A Back Geared, Screw Cutting, Foot Power Lathe. W. J. G., P. O. Box 293, N. Y.

A Microscope with 100 mounted objects for one dollar; circulars free. Address D. L. Smith, Waterbury, Ct.

Velvet Looms Wanted.—Manufacturers please send price lists to W. Lillenthal, 40 Lispenard St., N. Y. city.

Electrical and Mechanical Engineer and Expert. James Hamblet, 114 Tremont St., Boston, Mass.

Wanted.—Cash prices and description, 15 and 30 horse power Stationary Engines and Boilers. Newell Sanders, Chattanooga, Tenn.

Wanted cheap for cash.—A good second-hand Back Geared Screw Machine. Address, giving maker's name, where to be seen, size of hole in spindle, and full particulars, H. A. B. Weymer, 22 N. 6th St., Philadelphia, Pa.

For New and Second Hand Boilers, send to Hilles & Jones, Wilmington, Delaware.

Friction Clutches for heavy work. Can be run at high speeds, and start gradual. Safety Elevators and Hoisting Machinery a specialty. D. Friable & Co., New Haven, Ct.

Polishing Tools and Supplies. Send for new price list. Greene, Tweed & Co., 18 Park Place, N. Y.

For Mill Gearing, Shafting, Pulleys, and Hangers, address T. B. Wood & Co., Manufs., Chambersburg, Pa., for price.

Steam Yacht "Hiawatha" for sale.—Length, 40 ft.; beam, 8 ft. 5 in.; engine, 12 H. P.; speed, 12 miles. For particulars apply to J. M. Meredith, Esq., Maiden Creek P. O., Berks Co., Pa.

34 inch Second-hand Planer, and 12 inch Jointer, or Buzz Planer, both in first-class order, for sale by Bentel, Margedant & Co., Hamilton, Ohio.

Wrenches.—The Lipsey "Reliable" is strongest and best. Six inch sample by mail 60 cents. Roper Caloric Engine Manufacturing Co., 91 Washington St., N. Y.

Cornice Brakes. J. M. Robinson & Co., Cincinnati, O.

Bolt Forging Machine & Power Hammers a specialty. Send for circulars. Forsyth & Co., Manchester, N. H.

The Cameron Steam Pump mounted in Phosphor Bronze is an indestructible machine. See ad. back page. Painters' Rapid Graining Process. J. J. Callow, Cleveland, O.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Safety Linen Hose for factories, hotels, and stores, as protection from fire. Greene, Tweed & Co., 18 Park Place, N. Y.

John T. Noye & Son, Buffalo, N. Y., are Manufacturers of Burr Mill Stones and Flour Mill Machinery of all kinds, and dealers in Dufour & Co.'s Bolting Cloth. Send for large illustrated catalogue.

Power & Foot Presses, Ferracute Co., Bridgeton, N. J.

Solid Emery Vulcanite Wheels.—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

1,000 3d hand machines for sale. Send stamp for descriptive price list. Forsyth & Co., Manchester, N. H.

Steel Castings from one lb. to five thousand lbs. Invaluable for strength and durability. Circulars free. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

For Best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay Sts., Brooklyn, N. Y. Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing metals. E. Lyon & Co., 470 Grand St., N. Y.

Sperm Oil, Pure. Wm. F. Nye, New Bedford, Mass.

Bound Volumes of the Scientific American.—I have on hand bound volumes of the Scientific American, which I will sell (singly or together) at \$1 each, to be sent by express. See advertisement on page 312. John Edwards, P. O. Box 726, N. Y.

For Boul's Paneling, Moulding, and Dovetailing Machine, and other wood-working machinery, address B. C. Machinery Co., Battle Creek, Mich.

Best Wood Cutting Machinery of the latest improved kinds, eminently superior, manufactured by Bentel, Margedant & Co., Hamilton, Ohio.

Water Wheels, increased power. O. J. Bollinger, York, Pa.

Patent Scroll and Band Saws. Best and cheapest in use. Cordesman, Egan & Co., Cincinnati, O.

Mill Stone Dressing Diamonds. Simple, effective, and durable. J. Dickinson, 64 Nassau St., N. Y.

Weldless Cold-drawn Steel Boiler and Hydraulic Tubes. Leng & Ogden, 212 Pearl St., N. Y.

For Best Insulated Telegraph Wire, Telephone Wire, and Flexible Cordage, Eugene F. Phillips, 67 Stewart St., Providence, R. I. W. H. Sawyer, Electrician and Supt.

Hand Fire Engines, Lift and Force Pumps for fire and all other purposes. Address Rumsey & Co., Seneca Falls, N. Y., U. S. A.

The Turbine Wheel made by Risdon & Co., Mt. Holly, N. J., gave the best results at Centennial test.

Vertical & Yacht Engines. N. W. Twiss, New Haven, Ct.

Dead Pulleys, that stop the running of Loose Pulleys and Belts, taking the strain from Line Shaft when Machine is not in use. Taper Sleeve Pulley Works, Erie, Pa.

NEW BOOKS AND PUBLICATIONS.

OLD HOMES MADE NEW. By William M. Woollett. Published by A. T. Bicknell & Co., New York city.

This is a collection of plans, exterior and interior views, illustrating the alteration and remodeling of several suburban residences. The object is to exhibit how buildings of the homely types commonly found in country towns may at small expense be converted into tasteful and even elegant structures. Many of Mr. Woollett's designs have been practically applied, and all are pleasing.

We have received the reports and awards of the Judges of Groups 21, 23, 24, 26, and 27 from the publishers, Messrs. J. B. Lippincott & Co., Philadelphia. The classes considered are Agricultural Machines, Medicine, Architecture, Plastic and Graphic Art, and certain machine tools. These documents will perhaps be useful as records of the Exposition; but as compared to what they might be, we scarcely think them of any particular value.

Notes & Queries

W. McE.—See answer 36, p. 155, vol. 37.

—T. W.—From your description we are unable to judge. Possibly the ax, storm, or fire may have been the cause.

—R. F. B.—See "Business and Personal" column, for addresses.—M. B. H.—You can find descriptions and details in Weisbach's "Mechanics and Engineering."

—M. E. S.—You cannot find all the directions in a book. Bourne's "Catechism of the Steam Engine," and Forey's "Catechism of the Locomotive," contain useful information on the subject.—H. R. B.—See answer No. 6, issue of April 13.—J. T. E.—You do not send enough details to enable us to form a decided opinion, but we imagine that the area of the chimney or some of the flues is too small. A simple remedy would be to make the surroundings of the boiler fireproof.—E. S. R.—It will be better to use a non-metallic handle.—W. A. S.—See answer No. 19, p. 155, issue of March 9, 1878. For your purpose the core need not be a permanent magnet, but may be of soft iron.

(1) C. H. & Co. write: We are manufacturers of cream colored earthen ware. Please inform us what to mix with the clay to have it a red color after it is burnt. A. Use a small quantity of red oxide of iron or red ochre.

(2) H. P. S. asks how to make an umbrella cover waterproof? A. Apply first a strong hot aqueous solution of soap, then solution of alum, sulphate of alumina, or lead acetate (sugar of lead); again the soap solution, and finally wash with hot water.

(3) W. D. S. asks: 1. Would it be possible for me to run hydrogen gas through the gas pipes of my house for lighting purposes instead of common illuminating gas? A. Hydrogen gas, when burning, gives a very pale bluish flame, insufficient for illuminating purposes. 2. Would there be any danger of the reservoir bursting, or could I keep it in the cellar safely? A. There would be danger. 3. How is hydrogen gas made? A. It is obtained in quantities by the action of dilute sulphuric acid upon scraps of iron or zinc contained in a large airtight vessel, connected by a pipe with the gas receiver, or by passing steam through red hot iron filings contained in an iron pipe, and collecting the gas over water.

(4) W. C. S. writes: Please give me a recipe for making a good quality of shoemakers' ink, to blacken the sole edges and heels of boots and shoes while damp, to be afterward polished with a hot iron made for the purpose. A. Dissolve an equal quantity each of ferrous sulphate (copperas) and gum arabic in a small quantity of boiling water, and add a very little extract of logwood solution. If it gums, dilute it a little with hot water. Concentrated solution of shellac in hot aqueous solution of borax is sometimes used in place of a portion of the gum.

(5) F. L. W. writes: The ceramic fever has led me to ask if there is any mode of transferring an engraving from the paper on which it is originally printed to any object, without requiring pressure to any great amount? A. Paper is prepared with bichromated gelatin, dried, and exposed to strong sunlight for some time beneath, and in contact with, a drawing or wood cut rendered translucent by oil (castor oil answers). The excess of chrome salt is removed by washing. The paper is then transferred, picture side down, to a plate of gypsum. A positive copy is thus obtained from a positive drawing, as only the unaltered gelatin sinks into the gypsum. By replacing the carbon of the ink with enamel colors designs can be printed on and burned into unglazed porcelain, etc.

(6) R. H. L. writes: I wish to etch broad letters and figures on glass by means of hydrofluoric acid gas. What wax or varnish is used which can be readily removed from the surfaces to be etched? A. Use beeswax or paraffin; warm the glass.

(7) C. A. A. writes: After the fruit is removed from peach cans we find the tin inside beautifully mottled like pearl. 1. Can this peculiar pearl-like mottle be given to common sheet tin artificially at a low cost? A. Wash the tin plate quickly with a mixture of 3 parts hydrochloric acid, 1 part nitric acid, and 3 parts water; rinse in water and dry with warm sawdust. The mother-of-pearl appearance—moiré metallique—is preserved by a thin lacquer of pale shellac in alcohol. 2. Can the mottles be made small or large at will? A. No; their size depends in a great measure upon the rapidity with which the plate was cooled on leaving the tin bath.

(8) J. S. B. asks: Does the Jablochkoff electric candle throw out much heat? A. Compared with the illuminating power, the amount of heat radiated from the candle is relatively small.

(9) S. K. S. asks: What quantity and number of covered wire must I use to make the strongest horseshoe electro-magnet, having a 3/4 inch core, using a Daniel battery of six cups, and what length should

each coil be? A. Wind a sufficient quantity of No. 30 copper wire (magnet insulation) to make each spool 1 1/2 inch in diameter and 3/4 inches long.

(10) C. W. asks: 1. How strong should telephone magnets be? A. They should be able to lift about their own weight of iron. 2. Should the spool wire touch the magnet? A. No; the core should be first covered with one or two layers of thin paper, and then wound with the insulated wire. 3. Will ferrotype plate answer for the disks? A. Yes. 4. Will two parallel cotton-covered wires, the size of fine sewing needles, laid close together, do to connect the instruments? A. Yes. 5. My instruments do not work, although I used about 1/4 oz. of No. 40 silk covered wire on each spool, the same length on both. A. Use more magnet wire wound in the manner mentioned in the answer to your second question, and see answer No. 19, p. 155, SCIENTIFIC AMERICAN of March 9, 1878.

(11) G. A. A. writes: I wish to run a steam pipe from a boiler to my house, a distance of 300 feet underground. What is the best non-conductor for packing the pipe, and how should it be laid? A. Asbestos is one of the best non-conductors, but is rather expensive. You can do pretty well by laying the pipe in a box, surrounded by coal ashes.

(12) F. H. M. asks: What is the rule for making a counterbalanced face wheel for engines? I had a crank engine (portable) that did not stand steady. The crank end of the connecting rod and fittings weigh 11 lbs., and the wrist pin 3 lbs. A triangular piece weighing 16 lbs. was put in the face wheel, which was said to be right, but it is no better than before. The engine is 6 x 12 inches, running 170 revolutions per minute. A. It is a common practice to place the counterweight directly opposite the crank, with its center of gravity at the same distance from the center of the shaft as the center of the crank pin, making its weight equal to weight of piston, piston rod, crosshead, and crank pin, plus half the weight of the connecting rod.

(13) C. H. S. asks: In fastening two pieces of wood with nails, which will make the stronger joining, to bore the outside piece, or force the nail through in the common way? A. The latter, we think.

(14) D. C. asks: How is the cold rolled shafting made so true as it is? A. By being passed through the rolls under heavy pressure.

(15) E. C. asks: 1. Which would be the best boiler to use for driving a thrashing machine, one built on locomotive style, or vertical? A. There is not a great deal of difference. There may possibly be a little advantage in the use of the locomotive type. 2. In running over rough roads with steam up, would there be any danger of explosion from turning and jolting? A. No. 3. Could an 8 horse power engine be moved with its own power without the use of horses to haul it? A. Yes.

(16) S. W. H. writes: A person here says that it takes 25 per cent more coal to make steam from water that is returned to the boiler from the steam radiators used in warming buildings, than if water from a river or well were used. Is it so? A. Ordinarily it is more economical to use the condensed steam from the radiators.

(17) G. F. P. writes: I think that a 2 horse power engine will give 4 horse power by connecting a 5 inch pulley on its main shaft to a 10 inch pulley on its driver shaft, by a belt, losing, of course, half the original speed. Is this correct? A. No.

(18) R. N. writes: J. C. can melt small quantities of brass easily in a common cylinder stove with a good draught, using hard coal, and setting the crucible well down into the fire. I have tried melting on the forge, and find this much easier and better.

(19) W. S. P. asks: How can I make a good quality of lemon sirup? A. Lemon juice (strained or defecated), 1 pint; sugar, 3 1/2 lbs.; dissolve by gentle heat and set it aside; in 24 hours remove the scum and decant the clear liquid. The common soda water sirups are made by dissolving in a gallon of water 8 lbs. of sugar, 2 ozs. of gum arabic, and about 1/4 oz. of tartaric acid; strained through uncolored flannel, and flavored to suit with any of the fruit extracts or ethers.

(20) J. C. L. asks: Is steam visible before it comes in contact with the atmosphere? A. No.

(21) A. E. R. asks: 1. How can the power of the voice be increased? A. The effect, in public halls, may be increased by sounding boards and by attention to the laws of acoustics in constructing buildings; the actual power can only be increased by practice. 2. Will the phonograph make less demand for shorthand reporters? A. It may.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

G. M. P.—The specimen in the red box is a micaceous clay; might be useful to makers of wall papers.—J. F. K.—The talcose schist may be auriferous. The sample does not appear to be.—G. F. L.—No. 1 is brown hematite and shale. No. 2 has every appearance of being a slag. It gives the reactions for iron. No. 3 is lithographic stone.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges with much pleasure the receipt of original papers and contributions on the following subjects:

Pendulum Experiment. By O. T.
Aerial Navigation. By H. C. H.
Quackery. By T. A.
Electrical and Acoustic Observations. By J. W. S.
Rapid Locomotive Building. By J. M. D.
Duration of Impressions on the Retina. By H. T.
Estimation of Sulphur in Organic Compounds. By W. W. I. and C. F.
The Metric System. By G. N. W.
Astronomic Discrepancies. By L. S. B.
Does the Sun Move?
New Optical Apparatus. By J. V. O.
What is Life? By T. R. McC. and E. R. E.
A Brilliant Meteor. By R. D. S.

Advertisements.

Inside Page, each insertion --- 75 cents a line.
Back Page, each insertion --- \$1.00 a line.
(About eight words to a line.)

Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.



WARRANTED THE BEST.
1 H. P. Boiler & Engine, \$150.
2 H. P., \$175. 3 H. P., \$200.
Tested to 200 lbs. Steam.

LOVEGROVE & CO.,
152 N. 3d St., Philadelphia, Pa.,
Builders of Engines and Boilers, 1 to 100 horse power. Send for circular and prices, and state size and style you want.

INCORUSTATIONS ON BRICK WALLS.
By WILLIAM TRAUTWINE. The various causes; Bricks Burned with Coal Fires; Sulphate of Magnesia; Dampness; Effect of common Mortar. Remedies. Also Report of Sub-committee on the same subject, appointed by the University of Pennsylvania. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 123. Price 10 cents. To be had at this office and of all newdealers.

SECOND-HAND ENGINES.
Portable and Stationary at Low Prices.
HARRIS IRON WORKS, TITUSVILLE, PA.

MINTON'S TILES.
Art, Decorative and Floor—g. Remit 9 cents postage for circulars. Anderson Merchant & Co., 58 Broadway, N.Y.



THE ONLY
Genuine GEISSER
SULPHUR LAY-
ING GRAIN SEP-
ARATOR. Cer-
tified for its
light and smooth
movements, also
SEPARATING
and CLEANING
all kinds of grain
Manufactured
only by
THE GEISSER MFG CO., Waynesboro, Franklin Co., Pa.

SETON HALL College South Orange, N. J.
Healthy, Comfortable, Modern.

LATEST and Best Books on Steam Engineering. Send stamp for catalogue. F. KIPPY, Bridgeport, Conn.

PIANO Beautiful \$1,600 Concert Grand Piano only \$425. Superb \$1,100 Grand Square Piano only \$255. Elegant \$800 Upright Piano, \$155. New Style Upright Piano, \$112.50. New Organs \$35. Handsome Parlor Organs, 12 Stops, 8 Set Reeds, only \$72.50. Church Organs, 16 Stops, only \$104.50. Immense New Steam Factory soon to be erected. Paper with much information about cos. of Pianos and Organs SENT FREE. Address
DANIEL F. BEATTY, Washington, N. J.

LEHIGH UNIVERSITY.—Tuition Free. CIVIL, MECHANICAL and MINING ENGINEERING; CHEMISTRY and METALLURGY; FUEL CLASSICAL INSTRUCTION; FRENCH and GERMAN; ENGLISH LITERATURE; INTERNATIONAL and CONSTITUTIONAL LAW; PSYCHOLOGY and CHRISTIAN EVIDENCES.
For Registers address
The Rev. John M. Leavitt, D.D., President, Bethlehem, Penna.

TELEPHONE MATERIALS SENT TO any address upon receipt of price, by draft, money order or registered letter. Wound Bobbins of correct size, and of finest silk-covered, Pure Copper Wire, 5c each; Steel Magnets, Powerfully Charged, 5c each; Pure and Polished Wood Handles, 75c each; Binding Posts, 3 c. per pair; all the Parts for a Pair of First-class Telephones, except the Diaphragms, \$4.00.
J. H. HUNNELL,
112 Liberty Street, New York.

THE Scientific American.

The Most Popular Scientific Paper in the World.
THIRTY-THIRD YEAR.

Only \$3.20 a Year including Postage. Weekly.
52 Numbers a Year.

This widely circulated and splendidly illustrated paper is published weekly. Every number contains sixteen pages of useful information, and a large number of original engravings of new inventions and discoveries, representing Engineering Works, Steam Machinery, New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Electricity, Telegraphy, Photography, Architecture, Agriculture, Horticulture, Natural History, etc.

All Classes of Readers find in THE SCIENTIFIC AMERICAN a popular resume of the best scientific information of the day; and it is the aim of the publishers to present it in an attractive form, avoiding as much as possible abstruse terms. To every intelligent mind, this journal affords a constant supply of instructive reading. It is promotive of knowledge and progress in every community where it circulates.

Terms of Subscription.—One copy of THE SCIENTIFIC AMERICAN will be sent for one year—52 numbers—postage prepaid, to any subscriber in the United States or Canada, on receipt of three dollars and twenty cents by the publishers; six months, \$1.00; three months, \$1.00.

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at \$3.20 each; additional copies at same proportionate rate. Postage prepaid.

One copy of THE SCIENTIFIC AMERICAN and one copy of THE SCIENTIFIC AMERICAN SUPPLEMENT will be sent for one year, postage prepaid, to any subscriber in the United States or Canada, on receipt of seven dollars by the publishers.

The safest way to remit is by Postal Order, Draft, or Express. Money carefully placed inside of envelopes, securely sealed, and correctly addressed, seldom goes astray, but is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to

MUNN & CO.,
37 Park Row, New York.

The Postal Union.—Under the facilities of the Postal Union, the SCIENTIFIC AMERICAN is now sent by post direct from New York, with regularity, to subscribers in Great Britain, India, Australia, and all other British colonies; to France, Austria, Belgium, Germany, Russia, and all other European States; Japan, Brazil, Mexico, and all States of Central and South America. Terms, when sent to foreign countries, Canada excepted, \$4. gold, for SCIENTIFIC AMERICAN, 1 year; \$4. gold, for both SCIENTIFIC AMERICAN and SUPPLEMENT for 1 year. This includes postage, which we pay. Remit by postal order or draft to order of Munn & Co., 37 Park Row, New York.

Valuable Practical Books.

THE SILVERSMITH'S HAND-BOOK. By Geo. R. Gee. Illustrated, 12mo. \$3.75.
THE PLUMBER AND SANITARY HOUSE. By S. B. Hellyer. Illustrated, 8vo. \$3.50.
THE METALLURGY OF IRON. By H. Bauer. Illustrated, 12mo. \$2.00.
BREWING: PRACTICALLY AND SCIENTIFICALLY CONSIDERED. By E. R. Southby. 12mo. \$3.75.
BOILER AND FACTORY CHIMNEYS. By Robert Wilson. 12mo. \$1.75.
THE BOY ENGINEERS. By J. Lukin. Illustrated, 12mo. \$1.75.
MATHEMATICAL THEORY OF THE STEAM ENGINE. By T. Baker. 12mo. \$3.75.
CLOCKS, WATCHES, AND BELLS. By Sir R. Becket. Illustrated, 12mo. \$1.75.
THE STEAM ENGINE FOR THE USE OF ENGINEERS. By D. Lardner. 12mo. \$3.75.
THE WATCH REPAIRER'S HAND-BOOK. By F. Kemio. 12mo. \$1.75.

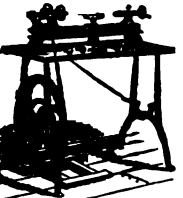
The above or any of our Books sent by mail, free of postage, at the publication price.
 Our new and enlarged CATALOGUE OF PRACTICAL AND SCIENTIFIC BOOKS—96 pages, 8vo—sent free to any one who will furnish his address.
HENRY CAREY BAIRD & CO.,
 Industrial Publishers, Booksellers, and Importers,
 810 Walnut Street, Philadelphia.

!!New and Improved!!
Engraving Process!!!
Perfect Substitute for Wood-Cuts.

Photo-Plate Company
 63 Duane St. New York.
 FINE ELECTROTYPE PRINTING.
 Can be printed on an ordinary Press.
 Send Stamp for Illustrated Circular.
 MUCH CHEAPER THAN WOODCUTS.
 State where you saw this.

A SPECIAL EXHIBITION
 of Working Machinery and Motors for small establishments will be held in August, 1878, at Erfurt, Germany. Applications for space will be received up to May 15, 1878. For programmes, terms, etc., address **MASCHINENMEISTER BORK, Erfurt, Germany.**

The Briggs Lathe.



A Superior Lathe at a low price. Also specialties in
Fine Tools, &c.
FRASSE & CO.,
 62 Chatham St., N. Y.
 P. O. Box 4627.

LAP WELDED CHARCOAL IRON
 Boiler Tubes, Steam Pipe, Light and Heavy Forgings, Engines, Boilers, Cotton Presses, Rolling Mill and Blast Furnace Work.
READING IRON WORKS,
 261 South Fourth St., Phila.

Telephone, all part: for one, \$2. Electric Call Bells, \$1.75. Send stamp for prices.
 A. D. Hard, 138 Blackstone St., Boston.

REVOLVERS.

We beg to call the attention of AGENTS and all DEALERS in Firearms to our new 5-shot Revolver, caliber 32 long, which for price, accuracy, and workmanship stands unrivaled. For special discounts, terms, and further particulars, address
MOHAWK MFG CO., Mohawk, N. Y.

RANDOLPH'S NEW DITCHER.



Reversible, Double Enders. Doing work of sixty men, by horse power, at cost of six! Surface Ditchers, Sod Cutters, and Steam Excavators—saving nine-tenths cost of work. Circulars from **RANDOLPH BROS.,** 111 Broadway, New York.

MONEY

to be made. Agent wanted for the Illustrated Family Herald, the largest paper in the U. S. 24 large pages. Twelve pages beautiful illustrations. Two elegant chromes free to each subscriber. Only \$1 for 16 months. Our agents are averaging from 20 to 50 subscribers each daily. One agent has just reported taking over 200 subscribers in three days. Takes at sight with everybody. Largest commission allowed agents. Terms free. Agents' complete outfit of chromes, sample papers, etc., etc., free to those who send 30 cents at once to pay the postage on it. Nothing else will pay you so well. Address **A. TRUE & CO., Augusta, Maine.**

WINDOW VENTILATORS.

The proprietors of the Window Ventilator Patents of the late J. W. Browne, Nos. 150,463, dated May 5, 1874, and No. 198,638, dated July 31, 1877, wish to lease them on royalty. Address
GRIFITH & BYRNE, 115 Leonard St., N. Y.

KREIDER, CAMPBELL & CO., 1030 GERMANTOWN AVE., PHILA.

Millwrights, Steam Engine Builders, and Mill Stone Manufacturers. Contractors for Paper, Flour, Malt, and Saw Mills, Breweries, Paint, Dye, and Chemical Works. Portable Mills, Hoisting Machines, and Patent Mill for Grinding Bones, Fertilizers, etc. Patent Paint Mills, Mill Bushes, Proof Stamps, Straight Edges, Bolting Cloth, Conveyors, Mill Furnishings. All orders for Jobbing promptly attended to. Trimmer's Patent Smutter, Grain and Scouring Machines.

RUBBER TYPE!

Cases of 125 movable letters, etc., with printing apparatus, \$1.50 by mail; samples of Type and circular, 6c. Address **Rubber Type Co., Mallet Creek, O.**

To Steel and Copper Plate Engravers

Ruling, Geometrical and Medallion Machines, Panto-graph Engraving Machines, Diamond Points.
HOPE & CO., Machinists, Providence, R. I.

THE BONANZA MONEY-HOLDER.

A chance for agents to start a bank account of their own. An article for carrying small pieces of coin in a compact form in the pocket. Great improvement over all others. You can see how much money you have without removing it from the holder. It is the best selling novelty in the market. We give large Commission. Sample, post-paid, 15c. One doz., \$1. Mammoth Illustr. Catalogue of other novelties, FREE.
E. NASON & CO., 111 Nassau St., N. Y.



DUC'S ELEVATOR BUCKET,

For use in Flour Mills, Grain Elevators, Sugar Refineries, etc. Made of Charcoal Stamping Iron, extra strong and durable. No corners to catch. Many thousands in use.

T. F. ROWLAND, Sole Manufacturer, Brooklyn, N. Y.

FORCE OF WIND. HOW TO ESTIMATE
 the Necessary Strength of Roofs, Towers, Tall Chimneys, etc., to withstand the Wind. The Solution of all Problems of the kind, with numerous Formula. Contained in **SCIENTIFIC AMERICAN SUPPLEMENT No. 109.** Price 10 cents. To be had at this office and of all news-dealers.



THE UNION IRON MILLS, Pittsburgh, Pa., Manufacturers of improved wrought iron Beams and Girders (patented).

The great fall which has taken place in the prices of iron, and especially in Beams used in the construction of FIRE PROOF BUILDINGS, induces us to call the special attention of Engineers, Architects, and Builders to the undoubted advantages of now erecting Fire Proof structures; and by reference to pages 53 & 54 of our Book of Sections—which will be sent on application to those contemplating the erection of fire proof buildings—THE COST CAN BE ACCURATELY CALCULATED, the cost of Insurance avoided, and the serious losses and interruption to business caused by fire; these and like considerations fully justify any additional first cost. It is believed, that, were owners fully aware of the small difference which now exists between the use of Wood and Iron, in many cases the latter would be adopted. We shall be pleased to furnish estimates for all the Beams complete, for any specific structure, so that the difference in cost may at once be ascertained. Address
CARNEGIE, BROS. & CO., Pittsburgh, Pa.

PATENTS SOLD.

For terms, address **EUROPEAN AND UNITED STATES PATENT EXCHANGE, 200 Broadway, N. Y. Box 2501.**

PATENTS AT AUCTION.

SPARE THE CROTON AND SAVE THE COST. Driven or Tube Wells

furnished to large consumers of Croton and Ridgewood Water. **WM. D. ANDREWS & BRO., 414 Water St., N. Y.,** who control the patent for Green's American Driven Well.

VANDERBURGH, WELLS & CO., 18 Dutch St., cor. Fulton, N. Y. ENGRAVERS' BOX-WOOD, MACHINISTS' PATTERNS & BRAND LETTERS.

The George Place Machinery Agency

Machinery of Every Description.
 121 Chambers and 103 Reade Streets, New York.

25 NEW YEAR CARDS, with name, 20c. 25 Extra Mixed, 10c. **Geo. I. Reed & Co., Nassau, N. Y.**

Lathes, Planers, Shapers

Drills, Bolt and Gear Cutters, Milling Machines. Special Machinery. **E. GOULD & EBERHARDT, Newark, N. J.**

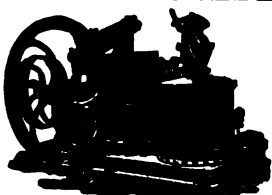
Wood-Working Machinery,

Such as Woodworth Planing, Tonguing, and Grooving Machines, Daniel's Planers, Richardson's Patent Improved Tenon Machines, Mortising, Moulding, and Re-Saw Machines, and Wood-Working Machinery generally. Manufactured by
WITHERBY, HUGG & RICHARDSON,
 26 Salisbury Street, Worcester, Mass.
 (Shop formerly occupied by R. BALL & CO.)

\$1200

Salary. Salesmen wanted to sell our Simple Goods to dealers. No peddling. Expenses paid. Permanent employment. Address **S. A. GRANT & CO., 2, 4, & 6 Home St., Cincinnati, O.**

THE BROWN CALORIC ENGINE,



Superior to any Hot Air Motor in Market. Is the most perfect substitute for any other power. Its special merits are: Simple construction and durability. The consumption of fuel is about 2 1/2 pounds per horse-power and per working hour. Accidents of explosive nature are impossible. No water tank. No extra insurance. These machines can be seen in sizes of 3 1/2, 7, and 14 horse power, at the
BROWN CALORIC ENGINE CO., 57, 59 & 61 Lewis St., N. Y.
 Larger sizes per contract. Apply for illustrated price list.

Aug. P. Brown's Safety Steam Engine Governor.
 Apply for circular.
 57, 59 and 61 Lewis St., New York.

ICE-HOUSE AND REFRIGERATOR.
 Directions and Dimensions for construction, with one illustration of cold house for preserving fruit from season to season. The air is kept dry and pure throughout the year at a temperature of from 34° to 36°. Contained in **SCIENTIFIC AMERICAN SUPPLEMENT No. 116.** Price 10 cents. To be had at this office and of all news-dealers.

Cement, Sewer, Culvert, Well, and Chimney Pipe Machinery.
E. DAYTON & SON, Meriden, Conn.

Can I Obtain a Patent?

This is the first inquiry that naturally occurs to every author or discoverer of a new idea or improvement. The quickest and best way to obtain a satisfactory answer, without expense, is to write to us (Munn & Co.), describing the invention, with a small sketch. All we need is to get the idea. Do not use pale ink. Be brief. Send stamps for postage. We will immediately answer and inform you whether or not your improvement is probably patentable; and if so, give you the necessary instructions for further procedure. Our long experience enables us to decide quickly. For this advice we make no charge. All persons who desire to consult us in regard to obtaining patents are cordially invited to do so. We shall be happy to see them in person at our office, or to advise them by letter. In all cases, they may expect from us a careful consideration of their plans, an honest opinion, and a prompt reply.

What Security Have I that my communication to Munn & Co. will be faithfully guarded and remain confidential?

Answer.—You have none except our well-known integrity in this respect, based upon a most extensive practice of thirty years' standing. Our clients are numbered by hundreds of thousands. They are to be found in every town and city in the Union. Please to make inquiry about us. Such a thing as the betrayal of a client's interests, when committed to our professional care, never has occurred, and is not likely to occur. All business and communications intrusted to us are kept secret and confidential.

Address **MUNN & CO.,**
 Publishers of the **SCIENTIFIC AMERICAN,**
 37 Park Row, New York.

THE DRIVEN WELL.

Town and County privileges for making Driven Wells and selling Licenses under the established American Driven Well Patent, leased by the year to responsible parties, by

WM. D. ANDREWS & BRO.,
 NEW YORK.

EAGLE FOOT LATHES,



Improvement in style. Reduction in prices April 20th. Small Engine Lathes, Slide Rents, Tools, etc. Also Scroll and Circular Saw Attachments, Hand Planers, etc. Send for Catalogue of outfits for Amateurs or Artisans.

WM. L. CHASE & CO.,
 95 & 97 Liberty St., New York.

SALESMEN WANTED \$125 A Month and Expenses with a DEALER in CIGARS. Send St. STAMP to CHASE & CO., 95 & 97 Liberty St., New York.

50 Best Mixed Cards, with name, in case, 13c. or 25 no 2 alike, 10c. Outfit 10c. **Dowd & Co., Bristol, Ct.**

Pond's Tools,

Engine Lathes, Planers, Drills, &c.
 Send for Catalogue. **DAVID W. POND, Successor to LUCIUS W. POND, Worcester, Mass.**

\$3 GOLD PLATED WATCHES, Cheapest in the known world. Sample Watch Free to Agents. Address **A. COULTER & Co., Chicago.**

Regular Monthly Sales the first week of each month by **George W. Keeler, Auctioneer,** at his sale-rooms, 53 and 55 Liberty Street, N. Y. For terms, etc., address **The New York Patent Exchange, 53 Liberty St., N. Y.**

ICE-HOUSE AND COLD ROOM.—BY R. G. Hatfield. With directions for construction. Four engravings. **SUPPLEMENT No. 59.** Price, 10 cents.

BAILEY'S PATENT Hydrants & Street Washers.

The best and cheapest in the market. Plumbers send for circular and prices to

Bailey, Farrell & Co.,
 Manufacturers of
Water, Gas & Steam Goods
PITTSBURG, PA.

NEW UNITED STATES GOVERNMENT
 Rules in Respect to Boilers, Boiler Inspection, Stamping and Testing of Boiler Plates, Fire Apparatus, and Boat Lowering Devices and Life Preservers. Instructions to Inspectors, and Tests of Boiler Material are to be made and recorded. Requirements in Construction of Boilers. The Law in full, with List of Approved Fire Extinguishing, Life Saving, and Boat-Lowering Apparatus. Contained in **SCIENTIFIC AMERICAN SUPPLEMENT No. 113.** Price 10 cents. To be had at this office and of all news-dealers.

\$2500 a year. Agents wanted everywhere. Business strictly legitimate. Particulars free. Address **J. WORTH & Co., St. Louis, Mo.**

65 MIXED CARDS, with name, 10c. and stamp. Agent's Outfit, 10c. **L. C. COE & Co., Bristol, Ct.**

MARK Your Linen with Clark's Indelible Pencils. Sold at all stationers.

For New Illustrated Catalogue of Foot Lathes, Scroll Saws, Slide Rents, and Amateurs' Tools, send stamp to **CHASE & WOODMAN, Newark, N. J.**

ON THE PRESERVATION OF WOOD.
 By J. CLARK JEFFERSON, A.B.S.M. How to store timber. How to measure timber and judge of its quality. Causes and Prevention of Dry and Damp Rot. Durability and Preservation of timber in Mines. The three methods of Artificial Preservation: 1. Cutting timber with Tar, etc. 2. Removing Sap by water or by steam. 3. Impregnating the wood by a solution of common salt, Sulphide of Barium, Sulphate of Zinc and Copper, etc. A valuable practical paper. Contained in **SCIENTIFIC AMERICAN SUPPLEMENT No. 119.** Price 10 cents. To be had at this office and of all news-dealers.

Improved HOISTING ENGINES.
Speedwell Iron Works,
 ESTABLISHED 1861.
 Office 96 Liberty St., N. Y.
 P. O. Box 2132.

MILL GEARING, Shafting, Pulleys & Hangers,
T. B. WOOD & CO., Manufg.,
 Chambersburg, Pa.

A \$12 Book for \$8.
BALDWIN LATHAM'S
"Sanitary Engineering."

A Guide to the Construction of Works of Sewerage and House Drainage. Illustrated with 10 Lithographed Plates 10x14 inches, containing 30 illustrations of the details and work of Sewers and House Drains. Price \$8.
GEO. H. FROST, Publisher,
 153 Washington St., Chicago, Ill.

PATENT MINERAL WOOL.
 Incombustible. The best non-conductor. For illustrated description see **SCIENTIFIC AMERICAN** of January 12th. **A. D. EBERHARDT,**
 254 Broadway, N. Y.

Diamonds & Carbor

Shaped or Crude, furnished and set for Boring Rocks, Dressing Mill Burrs, Emery Wheels, Grindstones, Hardened Steel, Calendar Rollers, and for Sawing, Turning, or Working Stone and other hard substances; also Glassers' Diamonds. **J. DICKINSON, 64 Nassau St., N. Y.**

BETON CONCRETE IN ARCHITECTURE

and Engineering, with 20 illustrations. **Beton Bridge;** **Erie R. R. Portage Viaduct** repaired with **Beton;** **Beton Dwellings and Fountain, Brooklyn, N. Y.;** **Beton Church;** **Beton Culvert, Lining, Erie R. R.;** **Beton Arches;** **Church Tracery, &c.;** **Beton-lined Railway Tunnels;** **Beton Pavements;** **Crushing Strength of Beton;** **Superior Strength of Beton Arches, etc.** Contained in **SCIENTIFIC AMERICAN SUPPLEMENT, No. 118.** Price 10 cents. To be had at this office and of all news-dealers.

Baker Rotary Pressure Blower.



(FORCED BLAST)

Warranted superior to any other.

WILBRAHAM BROS.,
 2318 Frankford Ave.
 PHILADELPHIA.

THE SCIENCE OF LIFE, OR, SELF-PRESERVATION.

Two hundredth edition, revised and enlarged, just published. It is a standard medical work, the best in the English language, written by a physician of great experience to whom was awarded a gold and jeweled medal by the National Medical Association. It contains beautiful and very expensive steel plate engravings, and more than 50 valuable prescriptions for all forms of prevailing diseases, the result of many years of extensive and successful practice. 300 pages, bound in French cloth; price only \$1, sent by mail, the London Lancet says: "No person should be without this valuable book. The author is a noble benefactor." An illustrated sample sent to all on receipt of 6 cents for postage. Address **DR. W. H. PARKER, 4 Bulfinch St., Boston.** The author may be consulted on all diseases requiring skill and experience.

Steel Name Stamps.

N. Y. STENCIL WORKS, 87 Nassau St., N. Y.

HOW TO BUILD A CHEAP CATAMARAN, with Malay Rig. Four illustrations. Full directions for construction and dimensions of a simple, fast, handy boat in actual use. Contained in **SCIENTIFIC AMERICAN SUPPLEMENT No. 117.** Price 10 cents. Also, in same number, description and full dimensions of the new yacht Intrepid. To be had at this office and of all news-dealers.

IMPORTANT FOR ALL CORPORATIONS AND MANFG CONCERNS.—Huerk's Watchman's Time Detector.

capable of accurately controlling the motion of a watchman or patrolman at the different stations of his beat. Send for circular. **J. E. BUEH, P. O. Box 979, Boston, Mass.**
 N. B.—The suit against Imhaeuser & Co., of New York, was decided in my favor, June 10, 1874. A fine was assessed against them Nov. 11, 1876, for selling contrary to the order of the court. Persons buying or using clocks infringing on my patent will be dealt with according to law.

MANUFACTURERS OF MACHINES OR INSTRUMENTS

suitable for England, India, or the Colonies, are requested to communicate with the advertisers, who have an extensive and well established concern in those markets, and make a specialty of the goods referred to. Ample references will be given. Address **J. J. WAINWRIGHT & CO.,** Cambridge Street Buildings, Birmingham, England.

25 Styles of Cards, 10c. or 10 Chromo Cards, 10c. with name. **J. B. HUSTED, NASSAU, N. Y.**

PERIN & CO. FRANCE. **JAFAY & CO. UNITED STATES.**



PERIN BAND-SAW BLADES.

"Know all Men by these Presents: That we, **Perin, Panhard & Co., of Paris, France,** have this day withdrawn the agency for the sale of our **Band-Saw Blades** from Mess. **Richards, London & Kelley,** and Mess. **London, Orton & Berry,** successors to Mess. **Richards, London & Kelley, Phil.,** and appoint Mess. **J. A. FAY & CO.**

of Cincinnati, Ohio, U. S. A., to be our sole and exclusive agents for the entire States and territories of the United States of America, with full power to prosecute all infringements and illegal use of the above trade mark. Witness our hands in Paris, France, January 1878."
PERIN, PANHARD & CO.,
 Successors to **Perin & Co.**
 W. TABAZIN.

As will be seen from the above announcement, we have been appointed sole and exclusive agents, for the United States, of the Celebrated

PERIN BAND-SAW BLADES!

and can furnish any sizes and lengths that may be required, joined, filed, and set, ready for use. Special sizes and lengths, not in stock, will be imported requiring about thirty days from receipt of order. All Blades will bear the trade Mark: **Perin & Co.** on one side, and **J. A. Fay & Co.** on the other. **Genuine Perin Blades** can only be procured from us or our agents, viz: **The George Place Mach. Ag'cy, New York;** **Utlies Baird, Pittsburgh;** **J. A. Fay & Co., Mach. Depot, Chicago;** **James Jenks, Detroit;** **J. A. Fay & Co., Mach. Depot, St. Louis;** **W. C. San Francisco;** **J. A. Fay & Co., Cincinnati, O.** Mfrs. of all kinds of Wood-working Machinery.

PATENTEES OF WALKING AND RIDING CULTIVATORS, Sulky and Walking Plows, and other Agricultural Implements, that wish to get them manufactured on a royalty, will correspond with **WM. M. JORDAN, Lexington, Mo.**

HOLCOMB'S Improved Acoustic Telephone

Patent Applied For. For short lines the best and cheapest Speaking Telephone manufactured. I have a test line of over 1 mile in length that transmits the voice with such power as to be heard distinctly in all parts of an ordinary room. Illustrated circulars for stamp. Address **J. R. HOLCOMB, Mallet Creek, Ohio.**

ENGLAND.—THE COMMERCIAL DEVELOPMENT of patented and other inventions is undertaken by the **INVENTORS' and GENERAL AGENCY (Limited),** 76 Chancery-lane, London, W. C.—Andrew Glendinning, Secretary.

POINTS OF A GOOD HORSE. BEING the Report of the Committee appointed by the New England Agricultural Society to decide upon Rules for Guidance of Judges of Horses. The Points of Excellence. Size, Color, Symmetry of Body, Head and Neck, Eye and Ear, Feet and Limbs, fully described. Speed at the Trot, and in Walking, Style and action of the hind legs, the percentage allowed for each quality. The Standard Size and Speed for Matched Carriage Horses, Gents' Driving Horses, Family Horses, Park or Phaeton Horses, etc. An excellent Guide in selecting animals. Contained in **SCIENTIFIC AMERICAN SUPPLEMENT No. 103,** price 10 cents. To be had at this office and of all news-dealers.

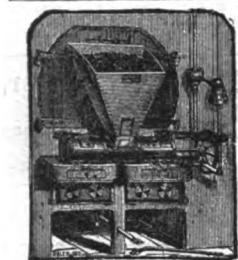
Advertisements.

Inside Page, each insertion --- 75 cents a line.
Back Page, each insertion --- \$1.00 a line.
(About eight words to a line.)

Engravings may be had at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

YOUNG MICROSCOPISTS

can get 10 odd numbers of Journal of Microscopy, post free, for 25 cents. Contain as much simple, practical information as can be had elsewhere for \$2. Address Box 4875, New York.



THIS INVENTION saves fuel, utilizes slack, increases and gives steady supply of steam, rendering opening of fire doors unnecessary, abates smoke nuisance, the power to drive is but little, and is the best known appliance for insuring perfect combustion. Address

U. S. Automatic Stoker Co., No. 2 Chestnut St., Philadelphia.

HAND SAW MILL SAVES THREE LABOR. S. C. HILLS, 78 Chambers St.

NOMENCLATURE OF MASONRY. By J. JAMES CROES, WILLIAM E. MERRILL, and EDGAR B. VAN WINKLE. A paper read before the American Society of Civil Engineers. An exhaustive article on Stone Cutting and Masonry, various Methods of Dressing, and Tools employed, with 34 illustrations, 13 Tools illustrated with Dimensions and How to Make. Squared, Quarry-faced, Pitched-face, and Drafted Stones, Rubble, Cut, Pointed, and Crandalled Stones, etc. Axed or Pean Hammered and Patent Hammered Stones. Bush Hammered and Rubbed Stones. Diamond Panels. Rubble, Squared Stone, Range, Random, and Ashlar Masonry, 34 illustrations in all, with practical instructions. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 113. Price 10 cents. To be had at this office and of all newsdealers.

Pyrometers. For showing heat of Ovens, Hot Blast Pipes, Boiler Flues, Superheated Steam, Oil Stills, &c. HENRY W. BULKLEY, Sole Manufacturer, 149 Broadway, N. Y.

JAPANESE ART MANUFACTURES. By Christopher Dresser, Ph.D., etc. Paper read before Society of Arts. The Japanese Potter at Work. Curious mode of Making Scarfs. How the Japanese Print on Cloth. Japanese Process for Silk Ornamentation. Japanese Weaving. How Fine Japanese Fans are made. Japanese Method of Making Moulds for Ornamental Castings for Vessels, Bronzes, etc. Japanese Lacquer Manufacture. Curious Method of Decorating Lacquer Work. The Love and Pursuit of the Beautiful in Japan. A very entertaining, instructive, and comprehensive paper. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 113. Price 10 cents. To be had at this office and of all newsdealers.

IMPROVED SOLID EMERY WHEELS. For grinding Iron and Brass Castings, Tools, etc. Manufactured by AM. TWIST DRILL CO., Woonsocket, R. I.



Bound Volumes OF THE Scientific American.

At present, I have on hand the following bound Volumes of the SCIENTIFIC AMERICAN, which I will sell at \$1.00 each, either singly or by the quantity.

OLD SERIES.	NEW SERIES.	NEW SERIES.
Vol. 7... 3 Copies.	Vol. 1... 5 Copies.	Vol. 15... 7 Copies.
" 11... 5 "	" 2... 6 "	" 16... 8 "
" 13... 4 "	" 3... 8 "	" 17... 9 "
" 14... 1 "	" 4... 6 "	" 18... 10 "
	" 5... 8 "	" 19... 11 "
	" 6... 10 "	" 20... 12 "
	" 7... 11 "	" 21... 13 "
	" 8... 12 "	" 22... 14 "
	" 9... 13 "	" 23... 15 "
	" 10... 14 "	" 24... 16 "
	" 11... 15 "	" 25... 17 "
	" 12... 16 "	" 26... 18 "
	" 13... 17 "	" 27... 19 "
	" 14... 18 "	" 28... 20 "

The books will be sent by express on receipt of price. Address all communications to JOHN EDWARDS, P. O. Box 773, New York.



BARNES' FOOT POWER MACHINERY.

13 Different machines with which Builders, Cabinet Makers, Wagon Makers, and Jobbers in miscellaneous work can compete as to QUALITY AND PRICE with steam power manufacturing; also Amateurs' supplies. MACHINES SENT ON TRIAL. Say where you read this, and send for catalogue and prices.

W. F. & JOHN BARNES, Rockford, Winnebago Co., Ill.

\$7 A DAY TO AGENTS canvassing for the Fire-side Visitor. Terms and Outfit Free. Address P. O. VICKERY, Augusta, Maine.

MILITARY AND SPORTING GUNS. Breech Loaders and Repeating Rifles, with horizontal and vertical chamber motions, Sporting Guns, with rotary arrangement for firing either ball or shot, and Revolvers, with side motion of barrel, are manufactured by N. V. DREYSE'S GUN WORKS, Sommerda, Prussia. Price lists sent gratis.

TO INVENTORS AND MANUFACTURERS

FOLLOWS & BATE, Manchester, England, Hardware and Machinery Merchants, are prepared to buy American Goods for Cash, and to act as Sole Wholesale Agents.

SPANISH CEDAR CIGAR-BOX LUMBER!

Finished Ready for Use.

First Quality at 34c. Second Quality at 24c. POPLAR—1st Quality at \$15 per M. Feet; 2d Quality at \$13.50 per M. Feet.

BUNDLING AND CARTAGE ADDITIONAL. Above prices will remain until advised. No order received for less than 1,000 feet.

GEO. W. READ & CO., 185 to 200 Lewis St., New York.

MARVIN'S FIRE & BURGLAR SAFES

COUNTER PLATFORM WAGON & TRACK SCALES

MARVIN SAFE & SCALE CO. 265 BROADWAY, N. Y.

ESTABLISHED 1844.
JOSEPH C. TODD, (Formerly of Todd & Rafferty), ENGINEER and MACHINIST. Steam Engines, Boilers, etc. I also manufacture the New Portable Engine of 1877, of one horse power, complete for \$125; can be seen in operation at my store. I will furnish specifications and estimates for all kinds of machinery. Send for descriptive circular and price. Address

J. C. TODD, 10 Barclay St., New York, or Paterson, N. J.

ASBESTOS

Liquid Paints, Roofing, Steam Pipe and Boiler Coverings, Steam Packing, Sheathing, Fire, Acid, and Waterproof Coatings, Cements, etc. Send for Samples, Illustrated Catalogues, Price Lists, etc.

H. W. JOHNS Mfg Co., 87 MAIDEN LANE, N. Y.

PUNCHING DROP HAMMERS AND DIES, FOR WORKING METAL & THE STILES & PARKER PRESS CO., Middletown, Conn.

CAMERON Steam Pumps

For Mines, Blast Furnaces, Rolling Mills, Oil Refineries, Boiler Feeders, &c. For Illustrated Catalogue and Reduced Price List send to Works, Foot East 23d St., New York.

An assortment of **WOOD-WORKING MACHINERY** made by Richards, London & Kelley (dissolved); also, a number of first-class MACHINE TOOLS (nearly as good as new) of Philadelphia construction, on hand and for sale. For list or inspection of machines and estimates, apply at the works of JOHN RICHARDS & CO., 22d and Wood Sts., Philadelphia, manufacturers of Standard Gauges and other Implements.

MANUFACTURE OF BESSEMER STEEL and Steel Rails as pursued at the works of Messrs. Brown, Bayley & Dixon, Sheffield. By C. B. HOLLAND. A valuable and instructive paper. Read before the Iron and Steel Institute. With Five illustrations: The Plant, the Cupolas, Converters, the Ingot Pit, Blowing Engines, Hydraulic Machinery, etc. Hot Blast; Mode of Working, Improved Manufacture of Steel Rails. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 124. Price 10 cents. To be had at this office and of all newsdealers.

WESTON DYNAMO-ELECTRIC MACHINE CO.

Machines for Electro-plating, Electrotyping, Electric Light, etc., in addition to testimonials in our Catalogue of Jan. 1. We beg to refer to the following houses: MERIDEN BRITANNIA CO.; RUSSELL & ERWIN MFG. CO.; REED & BARTON; HALL, ELLIOT & CO.; RICHARDSON, BOYNTON & CO.; WM. H. JACKSON & CO.; STANLEY WORKS; ROGERS CUTLERY CO.; CHAS. ROGERS BROS.; EDWARD MILLER CO.; MITCHELL, VANCE & CO.; NORWALK LOCK CO.; HAYDEN, GERE & CO.; DOMESTIC SEWING MACHINE CO.; EBERHARD FABER; JOS. DIXON CRUCIBLE CO.; MUMFORD & HANSON; FAGAN & SON, and over 20 others. Outfits for Gold, Silver, Bronze, Plating, etc. The two highest CENTENNIAL AWARDS, and the CENTENNIAL GOLD MEDAL of American Institute. Prices from \$125 to \$500.

CONDIT, HANSON & VAN WINKLE Sole Agents NEWARK, N. J.

BONE MILLS.

The best in the world. 5 sizes, adapted perfectly for Crushing and Grinding Minerals and all hard substances. Grinding surfaces quickly and cheaply renewed. Send for descriptive pamphlet.

BAUGH & SONS, PHILADELPHIA, PA.

THE PHONOGRAPH AND ITS FUTURE. By THOMAS A. EDISON. The instrument and its Action. Durability, Duplication, and Postal Transmission of Phonograph Plates. The probable great utility of the Phonograph in Letter-writing, Business Correspondence, and Dictation; Literature; Education; Law; Music; Oratory, etc. Application to Musical Boxes, Toys, and Clocks. Telegraphy of the Future; the Phonograph and Telephone combined. Being a most interesting and valuable paper by the author and inventor of the Phonograph himself. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 124. Price 10 cents. To be had at this office and of all newsdealers.

B. W. Payne & Sons, Corning, N. Y. Established in 1840

Eureka Safety Power.

h.p.	cyl.	ht.	space.	wt.	price.
2	3 1/2 x 4	48 in.	40 x 25	900	\$150
4	4 x 6	56	46 x 30	1600	250
6	5 x 7	72	72 x 42	2700	400

Also, SPARE ARRESTING PORTABLES, and Stationary Engines for Plantations. Send for Circulars.

PERFECT NEWSPAPER FILE

The Koch Patent File, for preserving newspapers, magazines, and pamphlets, has been recently improved and price reduced. Subscribers to the SCIENTIFIC AMERICAN and SCIENTIFIC AMERICAN SUPPLEMENT can be supplied for the low price of \$1.50 by mail, or \$1.25 at the office of this paper. Heavy board sides; inscription "SCIENTIFIC AMERICAN" in gilt. Necessary for every one who wishes to preserve the paper. Address

MUNN & CO., Publishers SCIENTIFIC AMERICAN.

Cut Brass Gears, list free. Grant, 94 Beverly St., Boston.

PORTLAND CEMENT, ROMAN & KEENE'S. For Walks, Cisterns, Foundations, Stables, Cellars, Bridges, Reservoirs, Breweries, etc. Remit 10 cents for Practical Treatise on Cements. S. L. MERCHANT & Co., 53 Broadway, New York.

TO ADVERTISERS! We will send free to all applicants who do any newspaper advertising, the THIRD EDITION of **AYER & SON'S MANUAL FOR ADVERTISERS.** 160 pp. More complete than any which have preceded it. Gives the names, circulation, and advertising rates of several thousand newspapers in the United States and Canada, and contains more information of value to an advertiser than can be found in any other publication. All lists have been carefully revised, and where practicable prices have been reduced. This special offer is numerous and unusually advantageous. Be sure to send for it before spending any money in newspaper advertising. Address N. W. AYER & SON, ADVERTISING AGENTS, Times Building, Philadelphia.

AHEAD OF ALL COMPETITION.



Seven Sizes for Hand Use. Weighing from 32 to 51 lbs. Three Sizes for Horse Power.

These Machines did an amount of work on the Centennial Grounds equal to 10 years of ordinary use, without loss of time for sharpening or repairs—completely distancing all competitors in that celebrated trial of 6 months duration. GRAHAM, EMLIN & PASSMORE, Patentees and Manufacturers, 651 Market St., Phila., Pa.

DAMPER REGULATORS **BEST** AND WEIGHTED GAUGE COCKS. MURRILL & KEIZER, 44 HOLLIDAY ST., BALTIMORE.

WIRE ROPE

Address JOHN A. ROEBLING'S SONS, Manufacturers, Trenton, N. J., or 117 Liberty Street, New York. Wheels and Rope for conveying power long distances. Send for circular.

WATSON'S NON-CHANGEABLE GAP LATHE HAS GREAT FACILITIES FOR LARGE OR MEDIUM SIZE WORK. JAMES WATSON, MANUFACTURER, 1508 & FRONT ST. PHILA.

ICE AT \$1.00 PER TON. The PICTET ARTIFICIAL ICE CO., LIMITED.

Room 51, Corn and Iron Exchange, P. O. Box 3083, N. Y.

MACHINISTS' TOOLS.

NEW AND IMPROVED PATTERNS. Send for new illustrated catalogue.

Lathes, Planers, Drills, &c. NEW HAVEN MANUFACTURING CO., New Haven, Conn.

Do **THE \$3 Press** Print in- etc. (Self-inked) 5 9 Larger sizes For business, pleasure, young or old Catalogue of Presses, Type, Etc., for 2 stamps. KESEY & Co. Meriden, Conn.

THE GEOLOGICAL ANTIQUITY OF Flowers and Insects. By J. E. TAYLOR, F.G.S. A plain, comprehensive review of the subject, bringing forward many instructive facts; with six illustrations. The invariable correlation between insects and flowers. How they are fossilized. Fossil botany. Geological Evidence of Evolution. Correspondence in the succession of Animal and Vegetable life. Flowers necessary to Insects, and Insects necessary to Flowers. Insects and Plants in the Devonian, the Switzerland Lias, the English Stonefield Slate, the Tertiary Strata, the Coal Measures, a Greenland, and other formations. A Peculiar Aspect of Evolution. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 120. Price 10 cents. To be had at this office and of all newsdealers.

Ithaca Calendar Clock.



Indicates perpetually the hour of the day, the day of the week, the day of the month, the month of the year. Indispensable in every business office. A necessity in every house. Manufactured in fifteen (15) different styles, to suit from the most common house to the most elaborate banking or counting house, prices ranging from ten (10) to fifty (50) dollars. Calendars printed in English, Spanish, Portuguese, French, and German languages. Catalogues, price lists mailed and inquiries answered promptly on application. For sale by all leading jewelers in United States and Canada. Manufacture at Ithaca, N. Y.

ITHACA CALENDAR CLOCK CO.

PUMPING. Rider Compression Engine. No steam, noise, or danger. Especially for suburban residences. Pumps 2,000 to 200,000 gallons water per day. CAMMEYER & SAVER, 93 Liberty St., N. Y.

HOLLOW SPINDLE LATHE.

Two sizes: 15 in. 1 1/4 in. hole; 18 in. 1 1/2 in. hole. Besides the most approved features of modern New England Tools, it has many new points of value, making it the best lathe ever offered for general use. HILL, CLARKE & CO., Machinery, Boston

WOOD-WORKING MACHINERY. New and improved, for special work. Boring Machines, Turning Lathes, Saw Arbors, Saw Benches, Scroll Saws, Panel Raisers, and other Wood Tools. We build the only patented Panel Raiser with vertical spindles, all others being infringements on our patents of July 11 and October 31, 1871. WALKER BROS., 73 and 75 Laurel St., Phila.

THE TANITE CO., STROUDSBURG, PA. EMERY WHEELS AND GRINDERS. GEO. PLACE, 121 Chambers St., New York Agent.

ROCK DRILLING MACHINES AND AIR COMPRESSORS. MANUFACTURED BY BURLEIGH ROCK DRILL CO. SEND FOR PAMPHLET. FITCHBURG, MASS.

Mill Stones and Corn Mills.

We make Burr Millstones, Portable Mills, Smut Machines, Packers, Mill Picks, Water Wheels, Pulleys, and Gearing, specially adapted to Flour Mills. Send for catalogue. J. T. NOYE & SON, Buffalo, N. Y.

HARTFORD STEAM BOILER Inspection & Insurance COMPANY.

W. B. FRANKLIN V. Pres't. J. M. ALLEN, Pres't. J. B. PIERCE, Sec'y.

MACHINISTS' TOOLS

Best quality at low prices. Radial Drills, Engine Lathes, Iron Planers, Car Wheel Boreers, Hydrostatic Presses, Axle Lathes.

NILES TOOL WORKS, Hamilton, Ohio.

H. R. WORTHINGTON,

239 BROADWAY, NEW YORK. Hydraulic Works, Van Brunt Street, Brooklyn, Manufactures Pumping Engines for Water Works, In daily use at 100 stations. Also Steam Pumps, Water Motors and Water Meters. See SCIENTIFIC AMERICAN SUPPLEMENT, January 27th, 1877. Prices largely reduced July 1st, 1877.

Working Models

And Experimental Machinery, Metal or Wood, made to order by J. F. WERNER, 62 Centre St., N. Y.

MICROSCOPES At Reduced Prices. Opera Glasses, Spectacles, Telescopes, Thermometers. Send for Illustrated Catalogue. R. & J. BECK, 921 Chestnut St., Philadelphia.

PATENTS

CAVEATS, COPYRIGHTS, TRADE MARKS, ETC.

Messrs. Munn & Co., in connection with the publication of the SCIENTIFIC AMERICAN, continue to examine Improvements, and to act as Solicitors of Patents for Inventors.

In this line of business they have had OVER THIRTY YEARS' EXPERIENCE, and now have unequalled facilities for the preparation of Patent Drawings, Specifications, and the Prosecution of Applications for Patents in the United States, Canada, and Foreign Countries. Messrs. Munn & Co. also attend to the preparation of Caveats, Trade Mark Regulations, Copyrights for Books, Labels, Reissues, Assignments, and Reports on Infringements of Patents. All business entrusted to them is done with special care and promptness, on very moderate terms.

We send free of charge, on application, a pamphlet containing further information about Patents and how to procure them; directions concerning Trade Marks, Copyrights, Designs, Patents, Appeals, Reissues, Infringements, Assignments, Rejected Cases, Hints on the Sale of Patents, etc.

Foreign Patents.—We also send, free of charge, a Synopsis of Foreign Patent Laws, showing the cost and method of securing patents in all the principal countries of the world. American inventors should bear in mind that, as a general rule, any invention that is valuable to the patentee in this country is worth equally as much in England and some other foreign countries. Five patents—embracing Canadian, English, German, French, and Belgian—will secure to an inventor the exclusive monopoly to his discovery among about one HUNDRED AND FIFTY MILLIONS of the most intelligent people in the world. The facilities of business and steam communication are such that patents can be obtained abroad by our citizens almost as easily as at home. The expense to apply for an English patent is \$75; German, \$100; French, \$100; Belgian, \$100; Canadian, \$50.

Copies of Patents.—Persons desiring any patent issued from 1836 to November 26, 1867, can be supplied with official copies at reasonable cost, the price depending upon the extent of drawings and length of specifications.

Any patent issued since November 27, 1867, at which time the Patent Office commenced printing the drawings and specifications, may be had by remitting to this office \$1.

A copy of the claims of any patent issued since 1866 will be furnished for \$1.

When ordering copies, please to remit for the same as above, and state name of patentee, title of invention, and date of patent.

A pamphlet, containing full directions for obtaining United States patents sent free. A handsomely bound Reference Book, gilt edges, contains 140 pages and many engravings and tables important to every patentee and mechanic, and is a useful hand book of reference for everybody. Price 25 cents, mailed free.

Address

MUNN & CO.,

Publishers SCIENTIFIC AMERICAN,

37 Park Row, N. Y.

BRANCH OFFICE—Corner of F and 7th Streets, Washington, D. C.

THE "Scientific American" is printed with CHAS. TENEU JOHNSON & CO.'S INK. Tenth and Lombard Sts., Philadelphia, and 59 Gold St., New York.